

Matthew W. Gissendanner
Senior Counsel
Dominion Energy Services, Inc.

220 Operation Way, MC C222, Cayce, SC 29033
DominionEnergy.com



May 28, 2021

VIA ELECTRONIC FILING

The Honorable Jocelyn Boyd
Chief Clerk/Administrator
Public Service Commission of South Carolina
101 Executive Center Drive
Columbia, South Carolina 29210

RE: Dominion Energy South Carolina, Inc.'s Request for Approval of
an Expanded Portfolio of Demand Side Management Programs
and a Modified Demand Side Management Rate Rider
Docket No. 2019-239-E

Dear Ms. Boyd:

In accordance with Order No. 2019-880 in the above-referenced docket, Dominion Energy South Carolina, Inc. hereby files with the Public Service Commission of South Carolina a copy of the Company's Evaluation, Measurement and Verification report ("EM&V Report") for Program Year 10, which consists of the time period December 1, 2019, to November 30, 2020.

By copy of this letter, we are also providing a copy of the EM&V Report to the South Carolina Office of Regulatory Staff and enclose a certificate of service to that effect. We are also providing counsel for the other parties in the above-referenced docket with a courtesy copy of the report.

Very truly yours,

A handwritten signature in blue ink that reads "Matthew W. Gissendanner".

Matthew W. Gissendanner

MWG/kms
Enclosures

cc: Andrew M. Bateman, Esquire
Jeffrey M. Nelson, Esquire
Derrick P. Williamson, Esquire
Stephanie R. Eaton, Esquire
William C. Cleveland IV, Esquire
Jenny P. Pittman, Esquire
(all via First Class U.S. mail and electronic mail w/enclosures)

BEFORE
THE PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA
DOCKET NO. 2019-239-E

IN RE:

Dominion Energy South Carolina, Request for)
Approval of an Expanded Portfolio of Demand)
Side Management Programs, and a Modified)
Demand Side Management Rate Rider)
_____)

**CERTIFICATE OF
SERVICE**

This is to certify that I have caused to be served this day copies of **Dominion Energy South Carolina, Inc.’s Evaluation, Measurement and Verification report (“EM&V Report”)** to the persons named below at the addresses set forth via U.S. First Class Mail and electronic mail:

Andrew M. Bateman, Esquire
South Carolina Office of Regulatory Staff
1401 Main Street, Suite 900
Columbia, SC 29201
abateman@regstaff.sc.gov

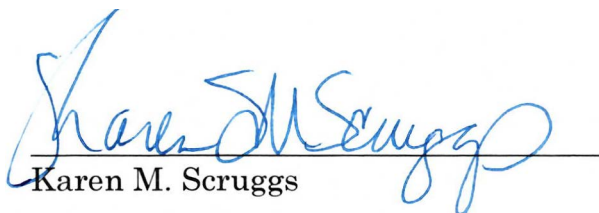
Jeffrey M. Nelson, Esquire
South Carolina Office of Regulatory Staff
1401 Main Street, Suite 900
Columbia, SC 29201
jnelson@regstaff.sc.gov

Jenny Pittman, Esquire
South Carolina Office of Regulatory Staff
1401 Main Street, Suite 900
Columbia, SC 29201
jpittman@regstaff.sc.gov

Derrick Price Williamson, Esquire
Spilman Thomas & Battle, PLLC
1100 Bent Creek Blvd., Suite 101
Mechanicsburg, PA 17050
dwilliamson@spilmanlaw.com

Stephanie U. (Roberts) Eaton, Esquire
Spilman Thomas & Battle, PLLC
110 Oakwood Drive, Suite 500
Winston-Salem, NC 27103
seaton@spilmanlaw.com

William C. Cleveland IV, Esquire
Southern Environmental Law Center
463 King St., Suite B
Charleston, SC 29403
wccleveland@seleva.org



Karen M. Scruggs

Cayce, South Carolina

This 28th day of May 2021



Opinion **Dynamics**

Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451



Dominion Energy South Carolina, Inc. EnergyWise Program Year 10: Evaluation, Measurement and Verification Report

May 26, 2021

Table of Contents

1. Executive Summary	1
2. Evaluation Methods	7
3. Program-Specific Findings	9
3.1 EnergyWise Savings Store.....	9
3.1.1 Program Description	9
3.1.2 Program Performance Summary	9
3.1.3 Data Review and Impact and Findings.....	10
3.2 Heating & Cooling Program.....	13
3.2.1 Program Description	13
3.2.2 Program Performance Summary	14
3.2.3 Impact and Data-Tracking Findings.....	15
3.3 Appliance Recycling Program.....	18
3.3.1 Program Description	18
3.3.2 Program Performance Summary	18
3.3.3 Impact and Data-Tracking Findings.....	19
3.4 Home Energy Reports.....	20
3.4.1 Program Description	20
3.4.2 Program Performance Summary	21
3.4.3 Impact and Data-Tracking Findings.....	21
3.5 Home Energy Check-Up.....	22
3.5.1 Program Description	22
3.5.2 Program Performance Summary	24
3.5.3 Impact and Data-Tracking Findings.....	26
3.6 Neighborhood Energy Efficiency Program.....	30
3.6.1 Program Description	30
3.6.2 Program Performance Summary	31
3.6.3 Impact and Data-Tracking Findings.....	33
3.7 Multifamily Program	36
3.7.1 Program Performance Summary	36
3.7.2 Impact and Data Tracking Findings.....	37

3.8	EnergyWise for Your Business Program	39
3.8.1	Program Description	39
3.8.2	Program Performance Summary	39
3.8.3	Impact and Data-Tracking Findings	40
3.9	Small Business Energy Solutions	43
3.9.1	Program Description	43
3.9.2	Program Performance Summary	43
3.9.3	Impact and Data-Tracking Findings	44
Appendix A.	PY10 Survey Response Rates and Representativeness	47
Appendix B.	EnergyWise Savings Store Detailed Methods	48
	Detailed Methods for Deemed Savings Evaluation	48
	Lighting Deemed Savings Estimation.....	48
	Non-Lighting Deemed Savings Estimation.....	51
	Ex-Ante and Revised Gross Per-Unit Deemed Savings Comparison.....	57
	Ex-Ante and Revised Gross Savings Summary	60
	In-Service Rates and Carryover Savings.....	63
	Net-to-Gross Methods and Results.....	64
	Online Store Non-Lighting Free Ridership Methodology	65
	Online Store Non-Lighting Spillover Methodology	66
Appendix C.	Heating & Cooling Detailed Methods	68
	Heating & Cooling Equipment Deemed Savings.....	68
	PY10 Heating & Cooling Equipment Engineering Algorithms and Assumptions	68
	Dual-Fuel Heat Pump Savings	70
	PY10 Heating & Cooling Equipment Deemed Savings.....	70
	Ductwork Deemed Savings	72
Appendix D.	Home Energy Check-up Detailed Methods.....	73
	Carryover Savings Calculation	73
	Carryover Calculation Method for Bulbs Distributed Since PY7	73
Appendix E.	Neighborhood Energy Efficiency Program Detailed Methods	76
	Energy Efficiency Kits ISRs.....	76
Appendix F.	Multifamily Program Detailed Methods.....	77
	Air Source Heat Pumps	77
	Duct Sealing.....	79

Programmable Thermostats	81
Lighting	82
Kitchen Faucet Aerators.....	83
Appendix G. EnergyWise for Your Business Detailed Methods.....	84
Sample Design	84
Realization Rate Summary.....	84
Desk Review Details by Application Type.....	85
Prescriptive and New Construction Lighting	85
Custom Projects.....	86
Prescriptive Non-Lighting Projects.....	88
Appendix H. Small Business Energy Solutions Detailed Methods.....	89
Desk Review Sample Design	89
Desk Review Detailed Findings.....	89

Table of Tables

Table 1. Portfolio Ex-Post Gross Savings, Costs, and Participation.....	3
Table 2. PY10 Ex-Post Gross and Net Savings	4
Table 3. Program Contribution to Overall Portfolio Gross and Net MWH Savings.....	4
Table 4. PY10 Ex-Post Gross Realization Rates	6
Table 5. Portfolio Evaluation Methods	8
Table 6. EnergyWise Savings Store Forecasts and Actuals	10
Table 7. EnergyWise Savings Store Gross and Net Savings Summary	10
Table 8. Online Store Savings Summary.....	11
Table 9. Low-Income Free LED Kits Savings Summary.....	12
Table 10. EnergyWise Savings Store Carryover Savings Claimed in PY10	12
Table 11. Heating & Cooling Program PY10 Program Measures and Rebate Amounts.....	13
Table 12. Heating and Cooling Program Forecasts and Results.....	14
Table 13. Heating & Cooling Program Number of Measures Rebated	14
Table 14. Heating and Cooling Program Gross Savings Summary	15
Table 15. Heating and Cooling Program Ex-Post Net Savings Summary	15
Table 16. Heating & Cooling Equipment Number of Measures Rebated	15
Table 17. Heating & Cooling Equipment Ex-Post Gross Savings Summary	16
Table 18. Heating & Cooling Equipment Ex-Post Net Savings Summary.....	16
Table 19. Ductwork Number of Measures Rebated.....	17
Table 20. Ductwork Ex-Post Gross Savings Summary	17
Table 21. Ductwork Ex-Post Net Savings Summary	18
Table 22. ARP Forecasts and Results	19
Table 23. ARP Total Recycled Appliances and Unique Participants	19
Table 24. ARP Number of Measures Rebated.....	19
Table 25. ARP Ex-Post Gross Savings Summary	20
Table 26. ARP Ex-Ante and Ex-Post Per Appliance Savings Comparison	20
Table 27. ARP Ex-Post Net Savings Summary	20
Table 28. PY10 HER Program Forecasts and Results	21
Table 29. PY10 HER Participation	22
Table 30. HER Ex-Post Net Savings Summary.....	22

Table 31. HEC Measures Summary	23
Table 32. HEC Energy Conservation Actions Recommended During the Visit	24
Table 33. HEC Forecasts and Results.....	25
Table 34. HEC Tier 1 Participation by Measure.....	25
Table 35. HEC Leave-Behind Measure Verification.....	26
Table 36. HEC LED ISR Calculation	27
Table 37. HEC Ex-Post Gross Savings by Measure Type (Before Carryover Savings)	27
Table 38. HEC Per-Bulb Savings Calculation	28
Table 39. HEC Ex-Post Gross Savings Summary (Before Carryover Savings).....	29
Table 40. HEC Ex-Post Net Savings Summary (Before Carryover Savings)	29
Table 41. HEC Total Savings Claimed in PY10	30
Table 42. Core Component Measures/Actions	30
Table 43. NEEP Recommended Energy Conservation Actions ^a	31
Table 44. NEEP Forecasts and Results.....	32
Table 45. NEEP Participation by Program Type.....	32
Table 46. NEEP Participation by Component and Measure	33
Table 47. NEEP Ex-Ante and Ex-Post Measure Quantity	34
Table 48. NEEP Per-Unit Deemed Savings Values	35
Table 49. NEEP Ex-Post Gross Savings Summary	36
Table 50. NEEP Net Savings Impacts.....	36
Table 51. Multifamily Forecast and Results	37
Table 52. Multifamily Measure Quantities.....	37
Table 53. Multifamily Database Review Adjustments.....	37
Table 54. Multifamily Ex-Post Gross Savings Summary Measure Category	38
Table 55. Multifamily Ex-Post Net Savings Summary	39
Table 56. EWfYB Forecasts and Results.....	40
Table 57. EWfYB Savings by Application Type.....	40
Table 58. EWfYB Database Review Adjustments	41
Table 59. EWfYB Ex-Post Gross Savings Summary	41
Table 60. EWfYB Summary of Differences Between Ex-Ante and Ex-Post Estimates	42
Table 61. EWfYB Ex-Post Net Savings Summary.....	42
Table 62. SBES Forecasts and Results.....	43
Table 63. SBES Participation and Savings by Segment.....	44

Table 64. SBES Database Review Adjustments	45
Table 65. SBES Ex-Post Gross Savings Summary	45
Table 66. SBES Ex-Post Net Savings Summary.....	46
Table 67. PY10 Survey Methods and Response Results.....	47
Table 68. Online Store: Baseline Wattages for Standard Bulbs.....	49
Table 69. Online Store: Baseline Wattages for Directional Bulbs	50
Table 70. Online Store: PY10 Non-Lighting Revised Deemed Savings.....	51
Table 71. Online Store Advanced Thermostat Savings Algorithms and Assumptions	52
Table 72. Online Store Tier 1 Advanced Power Strip Savings Algorithms and Assumptions	53
Table 73. Online Store Smart Socket Savings Algorithms and Assumptions	53
Table 74. Online Store Faucet Aerators Savings Algorithms and Assumptions	54
Table 75. Online Store Low-Flow Showerhead Savings Algorithms and Assumptions	55
Table 76. Online Store Shower Thermostatic Valve Savings Algorithms and Assumptions	56
Table 77. EnergyWise Savings Store Per-Unit Deemed Savings Comparison	57
Table 78. EnergyWise Savings Store Gross Savings by Channel and Product Type	60
Table 79. EnergyWise Savings Store First-Year ISR Values Applied for PY10.....	63
Table 80. EnergyWise Savings Store Lighting Installation Trajectories for Savings Claimed in PY10	63
Table 81. EnergyWise Savings Store Lighting Installation Trajectories for Savings Claimed in Future Years	64
Table 82. EnergyWise Saving Store NTGR Estimates Applied for PY10	65
Table 83. EnergyWise Saving Store Per-Unit Savings Estimates for Spillover Measures.....	67
Table 84. Full Load Hours.....	69
Table 85. Adjustment Factors.....	69
Table 86. Heating & Cooling Equipment Ex-Ante and Ex-Post Deemed Per-Ton Savings.....	70
Table 87. Ductwork Ex-Ante and Ex-Post Savings Per-Ton Comparison	72
Table 88. HEC Percentage of Stored Bulbs Installed by Year	73
Table 89. Quantity of CFLs and LEDs Installed in PY7.....	74
Table 90. HEC Carryover Gross Savings (Savings Added to PY10)	74
Table 91. HEC Carryover Net Savings (Savings Added to PY10)	75
Table 92. Number of Surveys Completed	76
Table 93: NEEP ISRs by Measure.....	76
Table 94. Algorithms and Input Assumptions for Heat Pump Replacement	78
Table 95. Algorithms and Input Assumptions for Duct Sealing (Performance).....	80
Table 96. Algorithms and Input Assumptions for Programmable Thermostats	81

Table 97. Algorithms and Input Assumptions for LEDs.....	82
Table 98. Algorithms and Input Assumptions for Kitchen Faucet Aerators.....	83
Table 99. EWfYB Prescriptive Lighting Sample Stratum and Sampling Parameters	84
Table 100. EWfYB Prescriptive Lighting Project Realization Rates.....	86
Table 101. EWfYB Prescriptive New Construction Lighting Project Realization Rates	86
Table 102. EWfYB Custom Projects Realization Rates	87
Table 103. EWfYB Prescriptive Non-Lighting Realization Rates.....	88
Table 104. SBES Lighting Sample Stratum and Sampling Parameters.....	89
Table 105. SBES Refrigeration Project Sample Stratum and Sampling Parameters	89
Table 106. SBES Lighting Project Realization Rates	91
Table 107. SBES Refrigeration Project Realization Rates.....	92

1. Executive Summary

Dominion Energy South Carolina, Inc. (DESC) began offering energy efficiency programs in October 2010 for electric customers. The period from December 1, 2019, through November 30, 2020, constituted their tenth program year (PY10). Over this period, DESC administered seven programs for residential electric customers and three programs for commercial and industrial (C&I) electric customers. The purpose of this report is to provide evaluated (i.e., “ex-post”) gross and net program energy and demand savings as compared to DESC’s forecasts and reported (i.e., “ex-ante”) savings for PY10.

DESC forecasted gross savings of 77,362 MWH and 18.05 MW for the PY10 portfolio of energy efficiency programs. The evaluation found total ex-post gross savings of 57,404 MWH and 14.68 MW, which fell short of the energy savings (74%) and demand (81%) forecasts. DESC also spent less than forecasted to implement the programs; DESC spent \$14.2M implementing the programs,¹ which was 64% of the spending forecast. Table 1 presents gross savings, costs, and participation for each program, comparing each to PY10 forecasts.

PY10 was mostly implemented in the 2020 calendar year and, as such, program performance was largely affected by the COVID-19 pandemic. The shelter-in-place order required DESC to pause in-person activities for up to six months for several residential programs. DESC re-opened these programs between June and September with alternative implementation approaches, including contactless appliance pickups, virtual Home Energy Check-up (HEC) audits, and drop-off kits with energy efficiency measures. Some of the usual program offerings, including Business Office Lighting and the mobile home weatherization offering through Neighborhood Energy Efficiency Program (NEEP), were not able to serve customers at all in PY10.

PY10 was the beginning of new program cycle for DESC; the first year of a new PY10–PY14 program plan. As such, PY10 involved a variety of program design and measure changes. The core offerings of DESC’s portfolio, however, remained largely consistent with previous years but had increased participation forecasts for all existing programs. DESC continued to offer residential customers discounted lighting and other products through the EnergyWise Savings Store (formerly the ENERGY STAR®² Lighting Program); rebates for HVAC equipment and ductwork through the Heating & Cooling Program; rebates for recycling appliances through the Appliance Recycling Program (ARP); Home Energy Reports (HER) with similar neighbor comparisons and energy savings tips; and free home energy assessments and energy efficiency measures through the HEC Program. DESC also continued to help income-qualified customers save energy and reduce energy bills by providing no-cost energy-efficient lighting and other products through its NEEP and the EnergyWise Savings Store’s “Free LED Kit” offering. The Small Business Energy Solutions (SBES) and EnergyWise for Your Business (EWfYB) programs continued to help C&I customers invest in lighting, refrigeration, HVAC, and other energy efficiency improvements.

In PY10, DESC also added two new programs to the portfolio: (1) the Multifamily Program, and (2) the Municipal LED Lighting program. DESC also added new elements, thus expanding several existing programs: discounts for advanced thermostats and smart sockets through the EnergyWise Savings Store and a new tier of incentives for building shell retrofits through HEC. DESC also made changes to incentive structures; increasing rebates to encourage more SEER 15 HVAC systems for existing homes; and increasing SBES incentives to 90% of project costs. Finally, DESC discontinued the opt-in model of the HER Program at the close of PY10 in anticipation of shifting to an opt-out model in PY11.

¹ Program costs reported here do not account for amortization or interest.

² All product or company names that may be mentioned in this publication are tradenames, trademarks or registered trademarks of their respective owners.

Below are some key highlights from this evaluation of the PY10 programs. There is further detail on these findings in each program's chapter of this report.

- Three programs exceeded forecasts despite the challenges stemming from the pandemic. The EnergyWise Savings Store (including the Online Store and Low-Income Kits) was the third largest contributor to portfolio savings and substantially exceeded savings forecasts. The Heating & Cooling Program continued to offer critical HVAC services throughout the year—ultimately exceeding savings and participation forecasts. The ARP program transitioned to contactless pickup and ultimately exceeded its energy and demand savings forecasts.
- Two programs were relatively stable throughout PY10 despite the pandemic. The EWfYB and SBES programs were the largest contributors to portfolio savings but did fall short of both participation and savings forecasts for EWfYB and only savings forecasts for SBES largely due to a six-month pause in on-site outreach. However, these programs still achieved more than 80% of their savings forecasts.
- Required implementation pauses due to the COVID-19 pandemic, as well as the subsequent design changes, substantially reduced portfolio performance compared to forecasts. This was particularly true for HEC and NEEP; two programs that rely heavily on in-person services.
- The HER program was unaffected by COVID-19 but fell short of participation and savings forecasts primarily due to DESC's decision to pause program enrollment in anticipation of transitioning to a new program design. Combined with natural program attrition, the pause in enrollment led to lower participation than forecasted.
- Given their later-than-expected launches in late PY10, DESC completed one project through the new Multifamily Program. While the program launched in PY10 and initiated some projects, the Municipal LED Lighting Program had no fully completed projects in PY10 therefore no savings are claimed in PY10.

Table 1. Portfolio Ex-Post Gross Savings, Costs, and Participation

Program Name	Ex-Post Gross				Program Costs		Participation		
	MWH Actual	% of Forecast	MW Actual	% of Forecast	Actual	% of Forecast	Actual	% of Forecast	Definition
EnergyWise for Your Business	30,903.59	83%	5.89	67%	\$4,321,733	54%	428	48%	Projects
Small Business Energy Solutions	7,036.17	81%	2.28	92%	\$3,052,049	186%	754	111%	Projects
EnergyWise Savings Store	6,437.89	118%	1.01	207%	\$1,104,854	215%	110,817	98%	Products
Heating & Cooling	5,777.48	115%	4.09	129%	\$3,076,380	99%	6,464	116%	Measures
Appliance Recycling	3,106.75	107%	0.35	101%	\$662,221	65%	3,112	71%	Appliances
Home Energy Reports	2,225.39	85%	0.83	84%	\$395,400	85%	34,712	92%	Customers / Households
Home Energy Check-Up	959.49	19%	0.13	15%	\$947,990	37%	1,704	47%	Customers
Neighborhood Energy Efficiency	952.43	19%	0.09	17%	\$386,013	40%	1,883	44%	Customers
Multifamily	4.44	0.2%	0.001	0.3%	\$100,028	12%	1	0.1%	Projects
Municipal LED Lighting	0	0%	0	0%	\$158,044	5%	0	0%	Measures
Total	57,403.63	74%	14.671	81%	\$14,204,712	64%	159,875	92%	N/A

Note: Values rounded for reporting purposes. This report compares ex-post gross savings to PY10 forecasts stated in Dominion Energy South Carolina's Annual Update on Demand Side Management Programs and Petition to Update Rate Rider submitted in January 2021 to the Public Service Commission of South Carolina <https://dms.psc.sc.gov/Web/Dockets/Detail/117668><https://dms.psc.sc.gov/Web/Dockets/Detail/117378>; program costs presented in the report do not account for amortization or interest (carrying costs). Home Energy Reports values are in ex-post net MWH and MW savings.

The overall portfolio achieved net savings (savings attributable to DESC's program offerings) of 43,797 MWH and 11.46 MW, which amounts to approximately three-quarters of the gross energy and demand savings. The net-to-gross-ratios (NTGRs) indicate that DESC's incentives and services are influencing the majority of program-participating customers to save energy, as shown in Table 2.

Table 2. PY10 Ex-Post Gross and Net Savings

Program Name	Energy			Demand		
	Gross MWH	NTGR	Net MWH	Gross MW	NTGR	Net MW
EnergyWise for Your Business	30,903.59	0.72	22,250.59	5.89	0.75	4.42
Small Business Energy Solutions	7,036.17	0.96	6,731.27	2.28	0.98	2.23
EnergyWise Savings Store	6,437.89	0.77	4,983.74	1.01	0.79	0.80
Heating & Cooling	5,777.48	0.70	4,057.63	4.09	0.68	2.76
Appliance Recycling	3,106.75	0.62	1,924.44	0.35	0.65	0.23
Home Energy Reports	2,225.39	1.00	2,225.39	0.83	1.00	0.83
Home Energy Check-Up	959.49	0.69	666.59	0.13	0.76	0.10
Neighborhood Energy Efficiency	952.43	1.00	952.43	0.09	1.00	0.09
Multifamily	4.44	1.00	4.44	0.001	1.00	0.001
Municipal LED Lighting	0	N/A	0	0	N/A	0
Total	57,403.63		43,796.52	14.671		11.461

Note: Values rounded for reporting purposes.

As shown in Table 3, most of the PY10 energy savings came from the commercial programs. The EnergyWise Savings Store and the Heating & Cooling Program contributed the most to residential savings. Since 2014, Energy Security and Independence Act (EISA) standards have shifted lighting baselines from incandescent to halogen, significantly reducing savings over time. The Evaluation Team has worked closely with DESC to monitor the lighting market in South Carolina and adjusted savings estimates to reflect the gradual phasing out of incandescent lamps. DESC anticipates that, despite the postponement of the next phase of EISA (EISA 2.0; originally planned for 2020), the lighting market will continue to change and, as such, the net savings potential from lighting will continue to decrease. DESC is working actively within the PY10–PY14 program cycle to identify and leverage new opportunities for savings.

Table 3. Program Contribution to Overall Portfolio Gross and Net MWH Savings

Program	Contribution to Gross MWH	Contribution to Net MWH
EnergyWise for Your Business	54%	51%
Small Business Energy Solutions	12%	15%
EnergyWise Savings Store	11%	11%
Heating & Cooling	10%	9%
Appliance Recycling	5%	4%
Home Energy Reports	4%	5%
Home Energy Check-Up	2%	2%
Neighborhood Energy Efficiency	2%	2%
Multifamily	<1%	<1%
Municipal LED Lighting	0%	0%

Executive Summary

Table 4 compares the ex-post gross savings (total estimated savings, exclusive of free ridership (FR) and spillover) to the savings reported in DESC's Annual Update on Demand Side Management (DSM) Programs and Petition to Update Rate Rider submitted in January 2021 to the Public Service Commission of South Carolina (ex-ante). The PY10 impact evaluation found ex-post savings equal to 96% of the ex-ante energy savings and 101% of the ex-ante demand savings.

Table 4. PY10 Ex-Post Gross Realization Rates

Program Name	MWH			MW			Reasons for Difference between Ex-Ante and Ex-Post
	Ex-Ante	Ex-Post	Realization Rate	Ex-Ante	Ex-Post	Realization Rate	
EnergyWise for Business	31,017	30,904	1.00	5.96	5.89	0.99	Updated HVAC controls savings methods, updated exterior lighting, chiller and new construction lighting coincidence factors, and updated baseline efficiency values for unitary HVAC and chillers
Small Business Energy Solutions	6,907	7,036	1.02	1.80	2.28	1.26	Applied coincidence and waste heat factors to ex-post calculations, updated per-unit savings to reflect building characteristics for lighting measures; included demand savings for cooler setback measures
EnergyWise Savings Store	8,749	6,438	0.74	1.32	1.01	0.77	Applied In-service rate (ISR)s and revised Free LED Kit ex-ante savings calculations; also revised per-unit savings and adjusted product quantities
Heating & Cooling	5,594	5,777	1.03	3.98	4.09	1.03	Adjusted SEER values for measures that were in-between deemed savings values (e.g., 16.5 SEER); also, adjusted some measures' capacity values and revised per-ton deemed savings for three new measures
Appliance Recycling	3,209	3,107	0.97	0.37	0.35	0.97	Updated per-unit savings using actual appliance characteristics in PY10 data
Home Energy Reports	2,233	2,225	1.00	0.84	0.83	0.99	Removed 113 customers from participation counts who final-billed (i.e., moved out) or opted out prior to receiving a PY10 report
Home Energy Check-Up	954	959	1.01	0.13	0.13	0.99	Applied ISRs for leave-behind measures, adjusted lighting baseline, and added lighting carryover savings
Neighborhood Energy Efficiency	1,352	952	0.70	0.12	0.09	0.77	Applied ISRs and updated deemed savings inputs for faucet aerators
Multifamily	6	4	0.76	0.002	0.001	0.79	Revised savings based on project documentation, including waste heat factors, heating capacity, duct leakage test results, existing and efficient HVAC equipment specifications, and flow rate
Total	60,020	57,404	0.96	14.52	14.671	1.01	

2. Evaluation Methods

The purpose of this report is to verify the actual PY10 gross and net energy and demand savings estimates and compare them to the DESC's forecasts and ex-ante estimates. The Evaluation Team conducted a variety of data collection and analytical methods to verify gross and net savings for each program. Given the team evaluated many of the programs and measures in recent years, and that many of the design changes were still in the initial stages of implementation, PY10 evaluation efforts relied upon much of the recent evaluation efforts for deemed savings, ISRs, and NTGRs. Below is a high-level description of the evaluation methods the team employed in PY10.

- **Database Review Verification:** The Evaluation Team reviewed program-tracking databases to ensure that there were no duplicates or database errors and that DESC had accurately applied all agreed-upon PY10 deemed savings for each measure.
- **Engineering Desk Review & Analysis:** The Evaluation Team conducted a full engineering desk review of measures in the PY1-PY9 evaluations. As a result, the Evaluation Team recommended the application of new deemed savings estimates for some measures prospectively in future program years. The team conducted this activity again in PY10 for select programs and measures; for example, advanced thermostats for the EnergyWise Savings Store. The team evaluated the Appliance Recycling Program measure savings based on the types of appliances that the program recycled in PY10. The team also evaluated Heating and Cooling and Multifamily measure savings based on program documentation, the baseline conditions, measure, and property characteristics in PY10.
- **Application of Previously Evaluated Inputs:** The Evaluation Team and DESC determined where to focus evaluation funds in PY10 based on implementation costs, specific needs for each program, and how the program was evaluated in previous years. As such, the team applied some of the previous evaluation findings to PY10 savings; for example, the team developed ISRs for measures in the SBES and HEC programs in previous evaluations and applied them to the measure counts in PY10.
- **Participant Surveys:** The Evaluation Team conducted surveys with representative samples of EnergyWise Savings Store's Online Store channel and NEEP Energy Efficiency Kits participants to develop revised ISRs and NTGRs.

Table 5 shows the data collection and analytical methods the Evaluation Team applied for each program. This report contains a chapter for each program that provides more detailed data collection and analytical methods, and even further details can be found in the Appendices. More rigorous evaluation methods are warranted in future program years and will occur in concert with the implementation timeline for new and expanded programs and measures in PY11. The Evaluation Team will work with DESC to determine the appropriate timing of evaluation activities based on the implementation timeline of expanded and new offerings.

Table 5. Portfolio Evaluation Methods

Evaluation Method	EnergyWise Savings Store	Home Energy Reports	Heating & Cooling	Home Energy Check-Up	Neighborhood Energy Efficiency	Appliance Recycling	Multifamily	EnergyWise for Your Business	Small Business Energy Solutions
Reviewed data-tracking systems against deemed savings and corrected tracking errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Application of previous evaluated findings (NTGR, verification, leakage, savings per participant and/or realization rates)	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Engineering desk review & analysis	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Project desk review								Yes	Yes
Participant surveys	Yes				Yes				

Note: The evaluation team reviewed program documentation and sample project data for the Municipal LED Lighting program, but it is not included in Table 5 since it will not be evaluated until PY11 when the program plans to claim its first savings.

3. Program-Specific Findings

3.1 EnergyWise Savings Store

3.1.1 Program Description

The EnergyWise Savings Store provides residential, electric customers with energy efficient products through two distinct channels. All residential customers can purchase discounted efficient lighting and an assortment of non-lighting products through the Online Store while eligible low-income customers were offered a free LED kit containing five LED bulbs.

Online Store

The Online Store offered residential customers a range of discounted energy efficient products:

- Standard and specialty LED products;
- Non-lighting products, including advanced power strips, low-flow showerheads and faucet aerators, smart thermostats, and smart sockets; and
- Three types of “Energy Saver” kits, which include 15 LED bulbs in various configurations and, in two of the three kit types, an advanced power strip.

Only customers with DESC electric service could purchase products through the Online Store, thus eliminating leakage to non-DESC customers. Further, DESC limited showerheads and faucet aerators to electric-only customers to ensure these measure go to those with electric water heaters. Customers could purchase up to 15 bulbs per eligible account per year based on previous evaluation recommendations. Energy Federation Inc. (EFI) implemented the program in the first half of PY10, but implementation transitioned to AM Conservation Group (AMCG) in June 2020.

Low-Income Free LED Kits

DESC direct mailed kits to targeted neighborhoods with a high proportion of income-qualified customers based on US Census data. This channel benefits NEEP eligible participants by cost-effectively reaching additional income-qualified neighborhoods that are too small for inclusion in NEEP and might otherwise be unable to receive free measures. Postcard recipients could claim one free LED kit by requesting it online or via telephone using a promo code. Each kit contained five standard LEDs, including three 9 W bulbs, one 11 W bulb, and one 15 W bulb; and educated the customer about the Online Store in the process.

3.1.2 Program Performance Summary

Table 6 summarizes the performance of the EnergyWise Savings Store against forecasts. DESC achieved 98% of its forecast for sold or distributed products at more than double the forecasted cost (215%). The program exceeded its gross energy savings forecasts (118%) and doubled its demand savings forecasts (207%). DESC’s decision to exceed the program budget for this program was made to offset the COVID-related decreases seen in other DSM programs offering in-home services and assisted the program in meeting both the energy and demand forecasts. Higher-than-expected adoption of smart thermostats also drove higher costs for the program compared to forecasts.

Table 6. EnergyWise Savings Store Forecasts and Actuals

Metric	Forecast	Actual	% of Forecast Accomplished
Cost	\$512,819	\$1,104,854	215%
Products	112,540	110,817	98%
Gross MWH	5,439	6,438	118%
Gross MW	0.49	1.01	207%
Net MWH	N/A	4,984	N/A
Net MW	N/A	0.80	N/A

Note: Values rounded for reporting purposes.

3.1.3 Data Review and Impact and Findings

To evaluate PY10 measure savings, the Evaluation Team: 1) reviewed program-tracking data, measure quantities, and per-unit savings values to determine “revised” gross savings; 2) applied ISRs to produce ex-post gross savings; and 3) applied NTGRs to estimate ex-post net savings. Lastly, the Evaluation Team added carryover savings from lighting products distributed during PY7, PY8, and PY9, but not installed until PY10. Additional detail on impact evaluation methods is available in Appendix B.

The Online Store remained the core contributor to overall program savings in PY10, accounting for 93% of ex-post gross savings; Low Income Kits provided the remaining 7% of savings. Before adding carryover savings, total program gross savings realization rates were 0.56 for energy savings and 0.66 for demand savings. The application of ISRs account for most of the difference between ex-ante and ex-post gross savings. The next largest driver was specific to Free LED Kits, where ex-ante savings erroneously applied per-kit savings values to bulb counts. This issue had a significant impact on Free LED Kits savings realization rate (0.13 for KWH and KW) but a moderate impact on overall program realization rates. In addition to these primary drivers, the realization rates also reflect relatively small per-unit savings revisions and product quantity adjustments. With the addition of carryover savings, final realization rates for the program increased to 0.74 for gross energy savings and 0.77 for gross demand savings. Table 7 summarizes PY10 energy and demand savings by channel and for the program overall.

Table 7. EnergyWise Savings Store Gross and Net Savings Summary

Program Component	Verified Quantity	Ex-Ante Gross		Revised Gross		Ex-Post Gross		Gross Realization Rate		Ex-Post Net	
		MWH	MW	MWH	MW	MWH	MW	MWH	MW	MWH	MW
Online Store	98,317	6,080	1.08	6,156	1.09	4,525	0.84	0.74	0.78	3,481	0.66
Low-Income Free LED Kits	12,500	2,669	0.24	550	0.05	336	0.03	0.13	0.13	319	0.03
Total from PY10 sales	110,817	8,749	1.32	6,706	1.14	4,860	0.87	0.56	0.66	3,800	0.69
Carryover savings from PY7 sales						427	0.04	N/A	N/A	321	0.03
Carryover savings from PY8 sales						439	0.04	N/A	N/A	333	0.03
Carryover savings from PY9 sales						711	0.06	N/A	N/A	531	0.05
Total PY10 savings						6,438	1.01	0.74	0.77	4,984	0.80

Note: Values rounded for reporting purposes.

Program Component Impact Details

The sections below detail the evaluation results for each channel.

Online Store

The Online Store incented nearly 90,000 LEDs of various types and wattages as well as over 3,700 advanced thermostats, 2,500 advanced power strips, 1,000 smart sockets, and 900 water-saving products.

The Evaluation Team reviewed program-tracking data for errors, gaps, and inconsistencies and applied evaluated per-unit deemed savings to produce revised gross savings. The total revised gross savings for Online Store is slightly higher than total ex-ante gross savings, which reflects several adjustments made by the Evaluation Team:

1. Developed per-unit deemed savings values for new products introduced in PY10;
2. Reviewed and updated per-unit deemed savings estimates for previously offered products, most of which either matched exactly with ex-ante estimates or differed only due to rounding differences for demand savings; and
3. Corrected instances where ex-ante estimates underestimated sales or return quantities by treating pack counts as bulb counts (e.g., ex-ante counted a pack of five bulbs as one bulb).

The Evaluation Team applied ISR estimates to revised gross savings to calculate ex-post gross savings and then NTGRs to calculate ex-post net savings:

- For lighting measures, the Evaluation Team applied ISR estimates based on a PY10 participant survey but used a PY6-evaluated NTGR of 0.73. The need to focus on new non-lighting measures in the survey reduced the available sample for lighting NTGR updates; and lead to insufficient sample size to be confident in results. As such, the Evaluation Team anticipates conducting further survey research and updating the lighting NTGR in PY11.
- For non-lighting measures, the team estimated ISR and NTGR values based on a survey of PY10 participants. One exception was smart sockets, which was a new measure introduced at the end of PY10. The team used ISR and NTGR assumptions from the Mid-Atlantic Technical Reference Manual (Version 9) for smart sockets pending further evaluation.

As shown in Table 8, the Online Store channel achieved 4,525 MWH and 0.84 MW in ex-post gross savings and 3,481 MWH and 0.66 MW in ex-post net savings. A more detailed breakout of ISR estimates and non-lighting NTGR values is available in Appendix B.

Table 8. Online Store Savings Summary

Online Store	MWH	MW
Ex-ante gross	6,080	1.08
Revised gross	6,156	1.09
ISR ^a	74%	
Ex-post gross	4,525	0.84
NTGR ^a	0.77	
Ex-post net	3,481	0.66

Note: Values rounded for reporting purposes.

^a Savings-weighted across measure types.

Low-Income Free LED Kits Impacts

The Low-Income Free LED Kits channel distributed 2,500 five-bulb LED kits, amounting to 12,500 LED bulbs. Each kit included three 9 W standard LEDs, one 11 W standard LED, and one 15 W standard LED.

Review of Low-Income Free LED Kits program-tracking data did not reveal any gaps or inconsistencies. However, in summarizing program savings, ex-ante estimates erroneously applied per-pack savings to each bulb; inflating total ex-ante savings by a factor of five. In addition to correcting for this issue, the Evaluation Team also updated per-unit deemed savings assumptions for 11 W and 15 W products to produce revised gross savings. The team then applied the PY7-evaluated ISR of 61% to determine ex-post gross savings. Lastly, the Evaluation Team applied the PY7-evaluated NTGR of 0.95 to determine ex-post net savings. As shown in Table 9, the Low-Income Free LED Kits channel achieved 336 MWH and 0.03 MW in ex-post gross savings and 319 MWH and 0.03 MW in ex-post net savings.

Table 9. Low-Income Free LED Kits Savings Summary

Low-Income Free LED Kits	MWH	MW
Ex-ante gross	2669	0.24
Revised gross	550	0.05
ISR	61%	
Ex-post gross	336	0.03
NTGR	0.95	
Ex-post net	319	0.03

Note: Values rounded for reporting purposes.

Carryover Savings

In addition to the first-year savings from bulbs distributed in PY10, total ex-post savings also include savings from bulbs that DESC distributed in prior program years and customers installed in PY10. Using a four-year installation trajectory, based on the Uniform Methods Project (UMP) approach, the Evaluation Team estimated that PY7, PY8, and PY9 bulb sales contributed 1,184 MWH and 0.11 MW in ex-post net carryover savings (Table 10). Appendix B contains further detail on carryover savings calculations.

Table 10. EnergyWise Savings Store Carryover Savings Claimed in PY10

Program Year	Ex-Post Gross		Ex-Post Net	
	MWH	MW	MWH	MW
Carryover from PY7	427	0.04	321	0.03
Carryover from PY8	439	0.04	333	0.03
Carryover from PY9	711	0.06	531	0.05
Claimable Carryover in PY10	1,578	0.14	1,184	0.11

Note: Values rounded for reporting purposes.

3.2 Heating & Cooling Program

3.2.1 Program Description

The Heating & Cooling Program offers rebates to DESC residential electric customers for installing high-efficiency air conditioners (ACs) and heat pumps (HPs) and improving ductwork. The program's primary goal is to assist customers with reducing electric consumption without compromising comfort in the home. To participate in the program, a customer must receive residential electric service from DESC in an existing, separately metered residence. Program marketing included monthly bill inserts, paid social media on Facebook and Instagram, internet radio ads on Spotify and Pandora, news release and quarterly outreach to contractors through email.

The largest component of the program is Heating & Cooling Equipment rebates, which helps offset the upfront cost for purchases of energy-efficient ENERGY STAR®-qualified HVAC units. The rebates vary according to HVAC type and efficiency level of the installed equipment. The second component of the program is Ductwork rebates, which supports complete replacement, sealing and/or insulation of existing duct systems.

DESC made minor changes to the program's eligible measures and rebate amounts near the end of PY10. DESC increased SEER 15 HVAC rebates by \$100 (to \$400) to encourage more customers to move to the first level of EnergyStar rated equipment. The program continued to offer rebates for complete duct replacements, duct sealing, and duct insulation as improvements to existing homes. Table 11 summarizes the rebates offered to customers and blue highlights show the changes during PY10.

Table 11. Heating & Cooling Program PY10 Program Measures and Rebate Amounts

Equipment Type	Minimum Efficiency Requirements	Rebate Amount (start of PY10)	Rebate Amount (end of PY10)
Packaged central air conditioner (CAC), air-source heat pump (ASHP), dual fuel heat pump (DFHP), and mini-split heat pumps (MSHP)	15 SEER and 12 EER (and 8.2 HSPF for HPs)	\$300	\$400
	CACs: ≥ 16 SEER and ≥ 12.5 EER HPs: ≥ 16 SEER and ≥ 12.2 EER and ≥ 8.3 HSPF	\$500	\$500
Split CAC, ASHP, DFHP, and MSHP	15 SEER and 12.5 EER (and 8.5 HSPF for HPs)	\$300	\$400
	≥ 16 SEER and ≥ 13 EER (and ≥ 9 HSPF for HPs)	\$500	\$500
Duct sealing	Duct leakage must be a 50% improvement of the existing duct leakage rate or 150 CFM reduction in leakage	\$150	\$150
Duct insulation	Minimum insulation $\geq R-8$	\$150	\$150
Complete duct replacement	Total leakage must be 10% or less	\$300	\$300

Note: SEER: Seasonal Energy Efficiency Rating; EER: Energy Efficiency Rating; HSPF: Heating Seasonal Performance Factor; CFM: Cubic Feet per Minute. Blue highlights indicate a change during PY10.

3.2.2 Program Performance Summary

As shown in Table 12, program performance exceeded participation and savings forecasts. The program continued to offer critical HVAC services throughout the COVID-19 pandemic and was notably resilient compared to other DESC residential programs that require in-person services; suggesting there was consistent, or perhaps increased, demand for HVAC services as many customers stayed or worked at home.

Table 12. Heating and Cooling Program Forecasts and Results

Metric	Forecast	Actual	% of Forecast Accomplished
Cost	\$3,116,379	\$3,076,380	99%
Measures	5,569	6,464	116%
Gross MWH	5,034	5,777	115%
Gross MW	3.18	4.09	129%
Net MWH	N/A	4,058	N/A
Net MW	N/A	2.76	N/A

Note: Values rounded for reporting purposes.

In PY10, the program served 5,928 customers who altogether installed 6,464 measures. The Heating & Cooling Equipment component represented most of the program measures (89%) and ASHPs alone account for more than half of all PY10 measures (57%). The Ductwork component altogether represented 11% of program measures; and complete duct replacement was the most common Ductwork measure. Table 13 summarizes the total number of installed PY10 measures.

Table 13. Heating & Cooling Program Number of Measures Rebated

Measure Type		Total Ex-Post PY10 Measures
Heating & cooling equipment	ASHP	3,687
	CAC	2,042
	DFHP	30
	Heating & Cooling Equipment subtotal	5,759
Ductwork	Complete duct replacement	621
	Duct sealing	50
	Duct insulation	34
	Ductwork subtotal	705
Total Heating & Cooling Program Measures		6,464

The Heating & Cooling Equipment component was also the largest contributor to overall program savings (86% of energy savings). Table 14 shows the total PY10 ex-post gross savings by program component.

Table 14. Heating and Cooling Program Gross Savings Summary

Program Component	Ex-Post Gross Savings	
	MWH	MW
Heating & Cooling Equipment	4,849	3.78
Ductwork	929	0.31
Total	5,777	4.09

3.2.3 Impact and Data-Tracking Findings

As shown in Table 15, the program achieved 5,777 MWH and 4.09 MW in ex-post gross savings. The gross savings realization rate for the program was 1.03 for both MWH and MW savings, reflecting minor adjustments to ex-ante savings estimates based on an engineering review. The Evaluation Team applied previously evaluated NTGRs to estimate total program ex-post net savings of 4,058 MWH and 2.76 MW.

Table 15. Heating and Cooling Program Ex-Post Net Savings Summary

Program Component	Ex-Ante Gross		Ex-Post Gross		Realization Rate		NTGR		Ex-Post Net	
	MWH	MW	MWH	MW	MWH	MW	MWH	MW	MWH	MW
Heating & Cooling Equipment	4,666	3.67	4,849	3.78	1.04	1.03	0.72	0.68	3,491	2.57
Ductwork	929	0.32	929	0.31	1.00	1.01	0.61	0.62	567	0.20
Total	5,594	3.98	5,777	4.09	1.03	1.03	0.70	0.68	4,058	2.76

Note: Values rounded for reporting purposes.

The following sections provide detailed impact findings for each program component.

Heating & Cooling Equipment Impact Findings

The Evaluation Team reviewed the program-tracking database to verify the total number of rebated measures. As shown in Table 16, the team found no duplicate measures in the program-tracking database.

Table 16. Heating & Cooling Equipment Number of Measures Rebated

Measure	Ex-Ante Quantity	Verification Rate	Ex-Post Quantity
ASHP	3,687	100%	3,687
CAC	2,042	100%	2,042
DFHP	30	100%	30
Total	5,759	100%	5,759

To estimate gross savings for Heating & Cooling Equipment measures, ex-ante and ex-post calculations apply per-ton deemed savings values. As new measures (i.e., new equipment type and efficiency combinations) enter the program, the Evaluation Team regularly estimates new per-ton deemed savings values. There were three new measures in PY10. For these measures, ex-ante applied a placeholder value, based on a similar existing measure and the Evaluation Team developed new per-ton deemed savings values. Appendix C summarizes

the PY10 deemed savings values for all Heating & Cooling Equipment measures, as well as the methods the team used to estimate per-ton deemed savings values for the new measures.

The PY10 Heating & Cooling Equipment component achieved ex-post gross savings of 4,849 MWH and 3.78 MW. The realization rates for energy and demand were 104% and 103%, respectively. The difference between total ex-ante and ex-post gross savings reflects four types of adjustments. The Evaluation Team: (1) rounded up SEER values for 737 measures that were in-between available deemed savings values (e.g., 15.5 SEER), whereas ex-ante rounded down in these cases to be conservative; (2) revised per-ton deemed savings for three new measures; (3) reviewed project documentation and applied corrected SEER values for 17 projects that had inconsistencies between tracking data fields; (4) adjusted capacity values for seven records where ex-ante applied values that were an order of magnitude too small. Table 17 compares the total ex-ante and ex-post gross savings by equipment type.

Table 17. Heating & Cooling Equipment Ex-Post Gross Savings Summary

Measure Type	Ex-Ante Gross		Ex-Post Gross		Gross Realization Rate	
	MWH	MW	MWH	MW	MWH	MW
ASHP	3,715	2.88	3,868	2.97	104%	103%
CAC	909	0.76	934	0.78	103%	102%
DFHP	42	0.03	46	0.04	109%	109%
Total	4,666	3.67	4,849	3.78	104%	103%

Note: Values rounded for reporting purposes.

The Evaluation Team applied PY8-evaluated NTGRs to estimate ex-post net savings. As shown in Table 18, the Heating & Cooling Equipment component achieved ex-post net savings of 3,491 MWH and 2.57 MW.

Table 18. Heating & Cooling Equipment Ex-Post Net Savings Summary

Measure Type	Ex-Post Gross		NTGR		Ex-Post Net	
	MWH	MW	MWH	MW	MWH	MW
ASHP	3,868	2.97	0.72	0.68	2,785	2.02
CAC	934	0.78			673	0.53
DFHP	46	0.04			33	0.02
Total	4,849	3.78	0.72	0.68	3,491	2.57

Note: Values rounded for reporting purposes

Ductwork Impact Findings

The Evaluation Team reviewed the program-tracking database to verify the total number of rebated measures. The Evaluation Team found no duplicate records or database errors within the program-tracking database and, therefore, did not adjust ex-ante measure quantities. Table 19 shows the resulting verified ex-post measure quantity is equal to the ex-ante measure quantity.

Table 19. Ductwork Number of Measures Rebated

Measure Type	Ex-Ante Quantity	Verification Rate	Ex-Post Quantity
Complete duct replacement	621	100%	621
Duct sealing	50	100%	50
Duct insulation	34	100%	34
Total	705	100%	705

To estimate gross savings for Ductwork measures, ex-ante and ex-post applied deemed savings values per-ton based on the home's HVAC system capacity (i.e., tonnage). The PY10 tracking database accurately tracked tonnage for all projects and, as such, there were no savings calculation differences between ex-ante and ex-post. PY10 deemed savings values for all ductwork measures are available in Appendix C.

As shown in Table 20, PY10 Ductwork measures achieved total ex-post gross savings of 929 MWH and 0.31 MW. The gross realization rate was approximately 100% overall for Ductwork energy and demand savings, with minor differences due to demand savings rounding.

Table 20. Ductwork Ex-Post Gross Savings Summary

Measure Type by HVAC System Type	Ex-Ante Gross		Ex-Post Gross		Gross Realization Rate	
	MWH	MW	MWH	MW	MWH	MW
Complete duct replacement (HP)	517	0.13	517	0.14	100%	101.1%
Complete duct replacement (AC)	342	0.16	342	0.16	100%	100.0%
Duct sealing (HP)	41	0.01	41	0.01	100%	99.9%
Duct insulation (HP)	14	0.00	14	0.00	100%	110.9%
Duct sealing (AC)	9	0.00	9	0.00	100%	100.0%
Duct insulation (AC)	6	0.00	6	0.00	100%	100.0%
Total	929	0.32	929	0.31	100%	100.6%

Note: Values rounded for reporting purposes.

The Evaluation Team applied PY3-evaluated NTGRs to estimate ex-post net savings. As shown in Table 21, the Ductwork component achieved ex-post net savings of 567 MWH and 0.20 MW.

Table 21. Ductwork Ex-Post Net Savings Summary

Measure Type by HVAC System Type	Ex-Post Gross		NTGR		Ex-Post Net	
	MWH	MW	MWH	MW	MWH	MW
Complete duct replacement (HP)	517	0.14	0.61	0.62	315	0.08
Complete duct replacement (AC)	342	0.16			209	0.10
Duct sealing (HP)	41	0.01			25	0.01
Duct insulation (HP)	14	0.00			8	0.00
Duct sealing (AC)	9	0.00			6	0.00
Duct insulation (AC)	6	0.00			4	0.00
Total	929	0.31	0.61	0.62	567	0.20

Note: Values rounded for reporting purposes.

3.3 Appliance Recycling Program

3.3.1 Program Description

The Appliance Recycling Program (ARP) offers incentives to DESC residential customers who recycle less efficient, but operable, primary and secondary refrigerators and/or stand-alone freezers. The program generates energy savings by removing the less-efficient measures from the market to ensure they do not continue to operate inefficiently within DESC's service territory. DESC offers the program to active residential electric customers seeking to recycle operational appliances between 10 and 30 cubic feet. Customers receive a \$50 rebate per appliance and are limited to two rebates per program year. In addition to the incentive, the program implementer, ARCA Recycling, takes away the old appliances free-of-charge.

In response to the COVID-19 pandemic, DESC suspended indoor pick-ups in March 2020 and implemented a "no-contact", outdoor (i.e., garage, porch, or driveway) pick-up option in April. In August 2020, DESC resumed indoor pick-ups and allowed customers to schedule either indoor or outdoor pick-ups.

Program marketing included monthly bill inserts, paid social media on Facebook and Instagram, radio ads on Spotify and Pandora, news releases, and "Smart Home Prize Pack" contests to help drive customer engagement. In November, to increase participation in the program, customers were offered a promotional rebate amount increasing the existing rebate from \$50 to \$100 per eligible unit that was extended into PY11. In addition, DESC provided a "What to Expect on Pickup Day" video on the program website to help customers better understand the recycling process and to highlight DESC's commitment as a partner with the Environmental Protection Agency's (EPA) Responsible Appliance Disposal Program (RAD).

3.3.2 Program Performance Summary

The ARP program fell short of participation forecasts, in part due to the COVID-19-related pause in operations, but ultimately exceeded its energy and demand savings goals by achieving significantly higher average per-appliance savings compared to forecasts; actual savings per unit was 50% larger than forecasts. Table 22 shows the program's actual versus forecasted results.

Table 22. ARP Forecasts and Results

Metric	Forecast	Actual	% of Forecast
Cost	\$1,024,268	\$662,221	65%
Participation (appliances)	4,383	3,112	71%
Gross MWH	2,909	3,107	107%
Gross MW	0.35	0.35	101%
Net MWH	N/A	1,924	N/A
Net MW	N/A	0.23	N/A

Note: Values rounded for reporting purposes

The program recycled a total of 3,112 recycled appliances for 2,899 participants. The majority (81%) of participants recycled one refrigerator, while others recycled one freezer or multiple appliances. Table 23 summarizes the number of unique participants and the number of recycled appliances in PY10.

Table 23. ARP Total Recycled Appliances and Unique Participants

Number and Type of Appliance	Total PY10 Measures	% of Total PY10 Measures	Number of Customers	% of Total Customers
1 refrigerator	2,357	76%	2,357	81%
1 freezer	331	11%	331	11%
1 refrigerator & 1 freezer	138	4%	69	2%
2 refrigerators	264	8%	132	5%
2 freezers	16	1%	8	<1%
3 refrigerators	6	<1%	2	<1%
Total	3,112	100%	2,899	100%

3.3.3 Impact and Data-Tracking Findings

The Evaluation Team reviewed the program-tracking database and found no duplicative records or tracking errors. Table 24 compares the ex-ante and ex-post measure quantities.

Table 24. ARP Number of Measures Rebated

Measure Type	Ex-Ante Measure Quantity	Verification Rate	Ex-Post Measure Quantity
Refrigerator	2,696	100%	2,696
Freezer	416	100%	416
Total	3,112	100%	3,112

As shown in Table 25, the program achieved 3,107 MWH and 0.35 MW in ex-post gross savings. Recycled refrigerators represent the majority (90%) of program savings. The overall gross realization rate is 0.97 for both energy and demand savings. The difference between ex-ante and ex-post gross savings is due to the mixture of appliance characteristics in PY10; including appliance age, size (i.e., cubic feet), type (i.e., single door, side-by-side, chest), and use (primary or secondary appliance). Ex-ante savings estimates used a deemed savings value based on PY9-evaluated average savings. Ex-post savings used actual PY10 recycled appliance

characteristics and the UMP protocols.^{3,4} Calculating savings based on PY10 recycled appliance characteristics resulted in lower average per-appliance savings and, thereby, lower ex-post savings compared to ex-ante.

Table 25. ARP Ex-Post Gross Savings Summary

Measure Type	Ex-Post Quantity	Ex-Ante Gross		Ex-Post Gross		Gross Realization Rate	
		MWH	MW	MWH	MW	MWH	MW
Refrigerator	2,696	2,893	0.33	2,814	0.32	0.97	0.98
Freezer	416	316	0.04	293	0.03	0.93	0.92
Total	3,112	3,209	0.37	3,107	0.35	0.97	0.97

Note: Values rounded for reporting purposes.

Table 26 below compares ex-ante and ex-post per-appliance average savings.

Table 26. ARP Ex-Ante and Ex-Post Per Appliance Savings Comparison

Measure Type	Ex-Ante Average Per-Appliance		Ex-Post Average Per-Appliance		% Difference	
	KWH	KW	KWH	KW	KWH	KW
Refrigerator	1,072.91	0.122	1,043.59	0.119	-3%	-2%
Freezer	760.78	0.087	704.91	0.080	-7%	-8%

Note: Values rounded for reporting purposes.

The Evaluation Team applied PY5-evaluated NTGRs to the PY10 ex-post gross savings values to determine ex-post net savings. As shown in Table 27, the program achieved ex-post net savings of 1,924 MWH and 0.23 MW.

Table 27. ARP Ex-Post Net Savings Summary

Measure Type	Ex-Post Gross		NTGR		Ex-Post Net	
	MWH	MW	MWH	MW	MWH	MW
Refrigerator	2,814	0.32	0.61	0.64	1,716	0.21
Freezer	293	0.03	0.71	0.74	208	0.02
Total	3,107	0.35	0.62	0.65	1,924	0.23

Note: Values rounded for reporting purposes.

3.4 Home Energy Reports

3.4.1 Program Description

The Home Energy Reports (HER) program offers customers free monthly or bi-monthly reports, which compare customers' energy usage over time to a peer group. The reports also provide information to help participants identify, analyze, and act upon energy efficiency upgrade opportunities and energy-saving behaviors to reduce their household energy usage. The initial HER is a four-page customized report that provides participants with

³ Li, M.; Haeri, H.; Reynolds, A, "Chapter 7: Refrigerator Recycling Evaluation Protocol," in *The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures*. (Golden, CO; National Renewable Energy Laboratory, 2018) NREL/SR-7A40-70472. Available at: <https://www.nrel.gov/docs/fy17osti/68563.pdf>

⁴ The part-time use adjustment was informed by PY5-evaluated data.

a summary of their household energy use and focuses on whole-house electricity usage. After the introductory report, subsequent monthly or bi-monthly Home Energy Updates compare the customers' usage to a peer group, promote a variety of customized energy efficiency tips, and provide information about other DESC EnergyWise programs. The HER program offers three different options, including a mailed paper report, an emailed report, and an emailed report in combination with an online portal. Customers using the online portal have the opportunity to create a Custom Action Plan, wherein they can develop personalized energy efficiency goals.

DESC has historically used an "opt-in" model to recruit customers into the HER program, meaning the program offers customers the choice to enroll. This opt-in model is distinct from other HER programs implemented across the country, as most are "opt-out" models where customers default (i.e., auto-enroll) into the program using a randomized experimental design approach. DESC discontinued the opt-in program at the end of PY10 and plans to launch a re-designed opt-out program in PY11.

3.4.2 Program Performance Summary

As shown in Table 28, the HER program fell slightly short of PY10 savings (85%) and participation forecasts (92%), which was primarily driven by DESC's decision to pause program enrollment in anticipation of transitioning to the new program design. Originally, DESC did not expect to switch to the new design until PY13 and had forecasted participation levels to continue to grow across PY10 and PY11. The pause in enrollment, in combination with natural program attrition (customers move residences or opt-out) rates, led to lower participation than forecasted in PY10. Additionally, forecasts assumed a slightly higher savings per household than the deemed savings value for this program.

Table 28. PY10 HER Program Forecasts and Results

Metric	Forecast	Actual	% of Forecast Accomplished
Cost	\$464,564	\$395,400	85%
Participants (treatment households)	37,647	34,712	92%
Net MWH	2,606	2,225	85%
Net MW	0.99	0.83	84%

Note: Values rounded for reporting purposes.

3.4.3 Impact and Data-Tracking Findings

To determine ex-post savings, the Evaluation Team reviewed program tracking data for accuracy and then applied the most recent deemed (PY8-evaluated per-household) savings to each active PY10 participant.

Nearly 35,000 customers participated in the program at some point in PY10 ("active" participants). Approximately 2,400 exited the program mid-year, primarily by moving out of DESC territory, and one new customer enrolled. As shown in Table 29, there was a small discrepancy between ex-ante and ex-post participation counts. The Evaluation Team reviewed the first PY10 report calendar date for all customers who exited the program mid-year. Among these customers, 113 (4%) never received a PY10 report before exiting the program. Ex-post participant counts exclude these customers, resulting in 34,712 verified PY10 participants.

Table 29. PY10 HER Participation

Program Participants	Ex-Ante	Ex-Post	Difference
Total active PY10 participants	34,825	34,712	-113
Exited mid-year: Final bill	2,173	2,074	-99
Exited mid-year: Opt-out	301	287	-14
Enrolled mid-PY10	1	1	0

After confirming the number of participating households, the Evaluation Team determined ex-post net savings for the program by applying the PY8-evaluated average annual savings per household to the 34,712 verified active PY10 participants. Note, the consumption analysis models the Evaluation Team used to estimate average annual savings accounted for cases of prorated savings, i.e., when customers exited or enrolled in the program mid-year. As such, all participants receive the same deemed savings value.

PY10 ex-post net savings was 0.41% of household consumption, or 64.11 KWH and 0.024 KW per household. Applying these values to each participant resulted in 2,225 MWH and 0.83 MW in total ex-post net savings. The realization rate for the program was 1.00 (after rounding) for MWH savings and MW savings. The only source of discrepancy between ex-post and ex-ante savings is the removal of 113 customers who left the program before receiving reports; however, this difference is relatively negligible compared to the size of the program. Table 30 compares ex-post net savings to ex-ante.

Table 30. HER Ex-Post Net Savings Summary

HER Program	Ex-Ante	Ex-Post	Realization Rate
Total participants (treatment households)	34,825	34,712	1.00
Per Household Savings			
Percent savings per household	0.41%	0.41%	1.00
Average annual savings per household (KWH)	64.11	64.11	1.00
Average annual savings per household (KW)	0.024	0.024	1.00
Total Program Savings			
Program savings, all households (MWH)	2,233	2,225	1.00
Program savings, all households (MW)	0.84	0.83	0.99

Note: Values rounded for reporting purposes.

3.5 Home Energy Check-Up

3.5.1 Program Description

The Home Energy Check-up (HEC) Program provides residential electric customers in DESC's service territory with no cost home audits (called a "checkup"), energy usage consultations, and energy efficiency measures. In PY10, HEC included three distinct offerings:

- **HEC Tier 1: In-Home Energy Checkup:** In-person home visits with direct install and leave-behind measures;
- **HEC Tier 1: Virtual Energy Checkup (new in PY10):** One-on-one video call or telephone-based home checkup with a follow-up delivery of a 5-bulb lighting kit; and

- **HEC Tier 2: Building Envelope Installations (new in PY10):** Incentivized building shell and ductwork upgrades available to select high-usage, electric-only residential customers following an In-Home Energy Checkup (through HEC Tier 1).

Table 31 below summarizes the measures DESC provides within each of these offerings. More detail on each offering follows the table.

Table 31. HEC Measures Summary

Measure	Direct Installation Service Provided	Incentive Amounts
Tier 1: In-Home Energy Checkup		
Kit of five LED bulbs (three 10 W, one 12 W, and one 14 W)	In cases of incandescent bulb replacement only	No cost to the customer
Electric water heater insulating blanket, as appropriate when customer has electric water heating	Yes	
Hot water pipe insulation (six feet), as appropriate when customer has electric water heating	Yes	
Kitchen faucet aerator, as appropriate when customer has electric water heating	Yes	
Tier 1: Virtual Energy Checkup		
Kit of five LED bulbs (three 10 W, one 12 W, and one 14 W)	No – home delivery	No cost to the customer
Kitchen faucet aerator, as appropriate when customer has electric water heating and agrees to self-install within 30 days	No – home delivery	
Tier 2: Building Envelope Installations		
Air sealing	Yes – via contractor	Up to 75% of cost
Home insulation	Yes – via contractor	
Duct sealing	Yes – via contractor	

Program marketing for the Tier 1 In-Home Energy Checkup offering included bill inserts, paid social media campaigns, and website content. DESC also used cross-program marketing; for example, DESC promoted the HEC program as a first step to customers interested in rooftop solar and the low-income Community Solar Select program. DESC did not market Tier 2 broadly to its customers; rather, DESC identified potential candidates that met the qualification criteria (i.e., high energy usage and electric only) by reviewing customer billing data, then reached out directly to recruit them.

HEC Tier 1: In-Home Energy Checkup

DESC has historically offered in-person home checkups with direct install and leave-behind measures through the HEC program. In PY10, DESC renamed this offering “HEC Tier 1” to distinguish it from the new “HEC Tier 2” offering. During the checkup, a DESC representative, who is a certified Building Analyst Professional through the Building Performance Institute (BPI), identifies sources of high energy use and provides the customer with a list of low- and no-cost energy savings recommendations and tips (Table 32). The DESC representative reviews up to two years of consumption data.

Table 32. HEC Energy Conservation Actions Recommended During the Visit

Recommended Measures
Set thermostat at 68° F or lower in the winter and 78° F or higher in the summer
Install a smart thermostat
Replace air filters
Leave interior doors open and keep vents open for adequate air flow
Repair ducts
Have central heating and cooling system serviced
Upgrade attic insulation to a minimum of R-38
Caulk, seal, and weather-strip windows or doors
Adjust water heater temperature to 120° F
Replace incandescent lamps with LEDs
Unplug appliances, lights, TVs, computers, etc., when not in use

Note: Program materials further recommend visiting DESC's website or calling DESC. The leave-behind materials also included information about Heating and Cooling Rebates, the Appliance Recycling Program, and the EnergyWise Savings Store.

During the in-home checkup, the DESC representative provides direct installation of kitchen faucet aerators, water heater blankets and pipe wrap insulation (where applicable) and ENERGY STAR LED bulbs when replacing incandescent bulbs. The DESC representative otherwise leaves the additional LEDs for the customer to self-install.

HEC Tier 1: Virtual Energy Home Checkup

The COVID-19 global pandemic caused DESC to pause in-home activities in early PY10. After pausing for approximately three-months, DESC pivoted to an alternative version of the Tier 1 offering in the summer of 2020 that was entirely contactless and allowed DESC to continue to provide energy efficiency services to customers. The DESC representative provided customers with similar services to the in-person Tier 1 offering and the same list of recommended measures through a video chat or telephone call. After the virtual checkup, DESC delivers an energy efficiency kit to the participant's home for the participant to self-install. The kits included the same five LEDs as the Tier 1 in-home checkups, as well as a kitchen faucet aerator, if a customer agreed to install the aerator.

HEC Tier 2: Building Envelope Installations

In late PY10, DESC began offering incentives to select high-usage, electric-only customers for home insulation, ductwork, air sealing, and other building envelope efficiency measures following HEC Tier 1 participation. DESC offered measures specific to the home found during the HEC Tier 1 Checkup and covered up to 75% of the cost of eligible improvements. Due to COVID-19, DESC delayed implementation of this new offering until late PY10. While DESC began several projects near the end of PY10, no projects were complete before the end of the program year to be included. As such, DESC did not claim savings for this offering in PY10.

3.5.2 Program Performance Summary

In PY10, the program fell short of participation targets (47%), as well as energy (19%) and demand (15%) savings forecasts. The primary driver was the disruption of usual program operations due to COVID-19, however three additional factors also contributed. First, savings forecasts did not account for ISRs. Second, virtual checkups yielded lower per-participant savings than forecasted as the delivered kits excluded pipe

insulation and water heater blankets. Third, forecasts also assumed that DESC would begin installing low-flow showerheads in greater numbers. However, DESC decided not to rollout this new measure due COVID restrictions (i.e., limiting time in the home) and cost-effectiveness concerns. Table 33 summarizes the forecasts and actuals in terms of costs, participation, and energy and demand savings.

Table 33. HEC Forecasts and Results

Metric	Forecast	Actual	% of Forecast Accomplished
Costs	\$2,540,517	\$947,990	37%
Participants	3,604	1,704	47%
Gross MWH	4,947	959	19%
Gross MW	0.85	0.13	15%
Net MWH	N/A	667	N/A
Net MW	N/A	0.10	N/A

Note: Values rounded for reporting purposes.

Tier 1 Participation Summary

The Tier 1 offering performed checkups for 1,704 residential customers during PY10. About two-thirds of these customers (1,090 participants; or 64%) received an in-home checkup, while the remaining third (36%) received a virtual checkup. All but six participants received LEDs. Approximately 10% of participants received hot water measures because DESC only provided these to customers who both received an in-home checkup and use electricity for water heating. Table 34 summarizes the Tier 1 offering participation.

Table 34. HEC Tier 1 Participation by Measure

Measure	Number of Participants Who Received the Measure			% of Total Participants	Total Measures Distributed in PY10 ^a	Unit
	Total (N=1,704)	In-Home (n=1,090)	Virtual (n=614)			
LEDs	1,698	1,088	610	99.6%	8,490	Bulbs
Electric water heater insulating blanket	192	192	0	11%	192	Blankets
Hot water pipe insulation	189	189	0	11%	1,134	Feet
Kitchen faucet aerator	167	142	25	10%	167	Aerators

^a Measure totals do not sum to the total participants because participants typically received multiple measures.

Tier 2 Participation Summary

Although COVID-19 delayed this new offering, DESC still carried out several activities in PY10. DESC selected a Tier 2 implementation contractor, held program kickoff and design meetings, and began the first few projects in October 2020. DESC and implementation staff proceeded with the initial checkups of these projects while adhering to strict COVID-19-related safety protocols. Though the projects began in PY10, DESC did not complete them until early PY11.

3.5.3 Impact and Data-Tracking Findings

The impact evaluation included the following steps:

- The Evaluation Team reviewed the program-tracking database for accuracy;
- The team determined ex-post gross savings by applying PY8-evaluated leave-behind measure ISRs and per-unit deemed savings, with the exception of LEDs.
 - For LEDs, the team developed a weighted ISR and weighted per-bulb savings.
- The team determined ex-post net savings for all measures by applying PY8-evaluated net-to-gross ratios NTGRs to ex-post gross savings.
- The team applied carryover savings from lighting measures that DESC distributed in previous years and that customers installed in PY10.

The next sections provide detail on each of these steps.

Program-Tracking Database Review

The Evaluation Team reviewed the program-tracking database to verify the total number of participants and measures. The Evaluation Team did not find any duplicates within the data but did find four participants who had participated in the HEC program but did not have a record of receiving the checkup. After confirming with DESC that the participants did receive a checkup, the Evaluation Team adjusted these records. Next, the team applied ISRs to ex-ante measure quantities to determine ex-post measure quantities. Table 35 compares ex-ante and ex-post measure quantities.

Table 35. HEC Leave-Behind Measure Verification

Measure	Ex-Ante Measure Quantity	Verified Measure Quantity	ISR ^a	Ex-Post Measure Quantity	Unit
LEDs	8,490	8,490	75%	6,393	Bulbs
Electric water heater insulating blanket	192	192	61%	117	Blankets
Hot water pipe insulation	189	189	70%	132	6-foot packs
Kitchen faucet aerators	167	167	98%	164	Aerators

Note: Values rounded for reporting purposes.

^a ISR source: PY8 evaluation results, with the exception of LEDs. The LED ISR is a weighted average of the PY8 ISR of 74% for leave-behind LEDs (95% of bulbs) and a 100% ISR for bulbs directly installed to replace incandescent bulbs (5% of bulbs; see Table 36).

Table 36 presents the Evaluation Team's calculation of the weighted ISR for LEDs. Based on program-tracking data, 5% of the LEDs replaced incandescent lamps via direct installation. Considering the relatively small proportion of directly installed LEDs, the Evaluation Team determined it was reasonable to assume that customers did not remove the LEDs and applied an ISR of 100%. For the remaining 95% of LEDs, the team applied the PY8-evaluated ISR of 74%. The Evaluation Team plans to update ISR assumptions in PY11 through a participant survey, if enough participation occurs.

Table 36. HEC LED ISR Calculation

LED Provision Method	Percentage of LEDs (N=8,490)	ISR	Weighted ISR
Leave-behind	95%	74% ^a	75%
Direct installation	5%	100%	

^a Source: PY8 evaluation

Ex-Post Gross Savings for PY10 Participants

To calculate ex-post gross savings, the Evaluation Team applied deemed savings values to ex-post measure quantities. As shown in Table 37, the program achieved ex-post gross savings of 856 MWH and 0.12 MW from PY10 participants. Recommended measure savings represented over half (56%) of ex-post gross MWH savings, followed by LEDs, which represented about a third of ex-post gross MWH savings (34%). More detail on the calculation of ex-post gross savings follows the table.

Table 37. HEC Ex-Post Gross Savings by Measure Type (Before Carryover Savings)

Measure	Ex-Post Measure Quantity	Unit	Per-Unit ^a		Ex-Post Gross	
			KWH	KW	MWH	MW
Recommended measures	1,704	Households	280.06	0.051	477	0.09
LEDs	6,393	Bulbs	45.13	0.004	289	0.03
Electric water heater insulating blanket	117	Blankets	360.80	0.041	42	0.01
Kitchen faucet aerators	164	Aerators	225.00	0.011	37	0.002
Hot water pipe insulation	132	6-foot packs	82.30	0.009	11	0.001
Total					856	0.12

Note: Values rounded for reporting purposes.

^a Source: The source for savings per unit is the PY8 evaluation, with the exception of LEDs. For LEDs, per-bulb savings is a weighted value that reflects a mixed baseline of incandescent and halogen bulbs. See Table 38.

Recommended Measures

DESC provided a list of recommended energy conservation actions to all 1,704 customers who received a checkup. Though DESC's ex-ante estimates originally included recommended savings for 1,700 customers, the Evaluation Team identified four missing records. As such, ex-post estimates include recommended measure savings for 1,704 participants. The Evaluation Team applied PY8-evaluated per-household energy savings of 280 KWH and demand savings of 0.05 KW to determine ex-post gross savings of 477 MWH and 0.09 MW.

LEDs

There were 1,698 customers who received a kit of five low-wattage LED bulbs; a total of 8,490 bulbs. As shown in Table 38, the team applied a weighted per-bulb savings value in PY10 that reflects a mixed baseline of halogen and incandescent bulbs. The Evaluation Team developed this assumption in PY9 based on a review of program tracking data, which revealed that 8% of participants' homes had only incandescent bulbs.

Table 38. HEC Per-Bulb Savings Calculation

Assumed Baseline	Percentage of LEDs (N=8,490)	Per-Bulb		Weighted Per-Bulb	
		KWH	KW	KWH	KW
Halogen	92%	43.36 ^a	0.004 ^a	45.13	0.004
Incandescent	8% ^b	65.48	0.006		

^a Source: Deemed savings from the PY8 evaluation.

^b Source: Review of PY9 program-tracking data.

The Evaluation Team applied a weighted ISR of 75% to determine that the ex-post quantity was 6,393, which led to ex-post gross savings of 289 MWH and 0.03 MW.

Electric Water Heater Insulating Blanket

There were 192 customers with electric water heaters that received water heater insulating blankets through the program. The Evaluation Team applied the PY8-evaluated ISR of 61% to determine that the ex-post quantity was 117 blankets, which led to ex-post gross savings of 42 MWH and 0.01 MW.

Kitchen Faucet Aerators

The program provided direct installation of kitchen faucet aerators to 142 in-home checkup participants and delivered 25 kitchen faucet aerators to virtual checkup participants. The Evaluation Team applied the PY8-evaluated ISR of 98% to determine that the ex-post quantity was a total of 164 faucet aerators, which led to ex-post gross savings of 37 MWH and 0.002 MW.

While DESC provided some faucet aerators with a kit after the virtual checkup, the Evaluation Team used the PY8-evaluated direct install faucet aerator ISR for these measures due to the relatively small number of measures provided through the virtual checkup (25 total; 15% of aerators). Additionally, DESC took steps to increase the likelihood of participants successfully installing the measures by assuring the presence of an applicable faucet, gauging participant interest in self-installing the product, and providing installation instructions along with a callback to schedule a virtual walk-through of the installation, if needed. DESC also followed up with five (20%) of the customers who received faucet aerators through the virtual offering to verify the installation. The Evaluation Team will update ISR assumptions for faucet aerators in PY11 through a participant survey.

Hot Water Pipe Insulation

There were 189 customers with electric water heaters and uninsulated hot water pipes that received six feet of hot water pipe insulation, for a total of 1,134 feet of hot water pipe insulation. The Evaluation Team found that DESC applied the per-foot hot water pipe insulation deemed savings value to the number of participants receiving the measure, instead of the total number of feet. The team applied the per-foot deemed savings value to the total number of feet, significantly increasing ex-post savings for this measure compared to ex-ante. The Evaluation Team then applied the PY8-evaluated ISR of 70% to determine that the ex-post quantity was 132 six-foot packs (or 792 feet), which led to ex-post gross savings of 11 MWH and 0.001 MW.

Low Flow Showerheads

Due to COVID restrictions and the increased in-home time that would be required to install a showerhead, DESC determined that it would not begin installations of low-flow showerheads in PY10. In PY11, the program will continue to assess the installation as either a Tier 1 or Tier 2 measure offer. In PY11, the HEC Team will

primarily focus on easier to install measures that provide higher energy savings while limiting customer interactions.

Program Ex-Post Gross Savings Summary

The program achieved ex-post gross savings of 856 MWH and 0.12 MW, resulting in realization rates of 0.90 for MWH and 0.92 for MW savings, as shown in Table 39. The key factor that drove the realization rates was the application of ISRs, which reduced ex-post savings compared to ex-ante. Several additional adjustments increased ex-post savings compared to ex-ante: 1) weighting lighting baselines; 2) correcting ex-ante application of deemed savings to hot water pipe insulation; and 3) adding four additional checkup records. However, these adjustments did not supersede the impact of ISRs on savings.

Table 39. HEC Ex-Post Gross Savings Summary (Before Carryover Savings)

Ex-Ante Gross		Ex-Post Gross		Realization Rate (Before Carryover)	
MWH	MW	MWH	MW	MWH	MW
954	0.13	856	0.12	0.90	0.92

Note: Values rounded for reporting purposes.

Net Verified Savings for PY10 Participants

The Evaluation Team applied PY8-evaluated NTGRs of 0.70 (MWH) and 0.77 (MW) to the total program ex-post gross savings to arrive at the total program ex-post net savings. Table 40 summarizes the total net savings for PY10 participants. The program achieved ex-post net savings of 599 MWH and 0.09 MW.

Table 40. HEC Ex-Post Net Savings Summary (Before Carryover Savings)

Ex-Post Gross		NTGR		Ex-Post Net	
MWH	MW	MWH	MW	MWH	MW
856	0.12	0.70	0.77	599	0.09

Note: Values rounded for reporting purposes.

Total Net Savings to Claim in PY10

Total claimable net savings in PY10 is greater than the savings from PY10 participants, as it also includes carryover savings from in-storage CFLs and LEDs from prior program years that prior participants did not install until PY10. The Evaluation Team estimated that, in PY10, prior participants installed 261 CFLs from PY7 and 2,152 LEDs from PY7, PY8, or PY9. See Appendix D for more detailed carryover savings calculations.

Table 41 summarizes final ex-post gross and net savings for HEC after adding carryover savings. Carryover savings contributed 104 MWH and 0.01 MW in additional gross savings, increasing gross MWH savings by 11% and gross MW savings by 7%. Applying leave-behind measure NTGRs from the years in which DESC distributed the carryover bulbs resulted in 68 MWH and 0.006 MW in additional net savings.

Table 41. HEC Total Savings Claimed in PY10

Savings Type	Gross		Net ^a	
	MWH	MW	MWH	MW
Ex-Ante PY10 (A)	954	0.13	668	0.10
Ex-Post PY10 Participants (B)	856	0.12	599	0.09
Ex-Post Total Carryover Savings Claimed in PY10 (C)	104	0.01	68	0.01
Total Ex-Post Savings Claim for PY10 (B+C=D)	959	0.13	667	0.10
Gross Realization Rate After Carryover (D/A)	1.01	0.99	N/A	N/A

^a Net savings takes into account the PY6-evaluated NTGR for PY7 leave-behind CFLs and LEDs (0.79 for electric energy savings and 0.74 for demand savings) as well as the PY8-evaluated NTGR for PY8 and PY9 leave-behind LEDs (0.62 for electric energy savings and 0.62 for demand savings).

3.6 Neighborhood Energy Efficiency Program

3.6.1 Program Description

The Neighborhood Energy Efficiency Program (NEEP) provides income-qualified residential neighborhoods in DESC's service territory with home walkthroughs and/or no-cost energy-saving measures. During PY10, NEEP had two distinct components:

- **Core:** An in-person home walkthrough and direct installation of energy-saving measures; and
- **Energy Efficiency Kits:** Contactless energy-saving measures drop-off.

NEEP provided the Core component during the first few months of PY10 but ceased in-home operations in March 2020 due to the COVID-19 pandemic. DESC shifted to the delivery of energy efficiency kits containing LEDs and faucet aerators in October 2020.

Core

The Core program component is NEEP's traditional offering. DESC conducts door-to-door sweeps in neighborhoods where approximately half of the households have income levels equal to or less than 150% of the Federal Poverty Guideline. Eligible households include single and multifamily residences as well as homeowners and renters. DESC offers customers a walkthrough of their home and direct installation of energy-saving measures; all at no cost to the customer. Depending on their needs, participants could receive any or all of the measures in Table 42.

Table 42. Core Component Measures/Actions

Direct Install Measures
Advanced power strips
HVAC filters
Kitchen faucet aerators
LEDs
Water heater pipe wrap
Water heater blankets
Water heater temperature adjustment

Energy Efficiency Kits

In PY10, DESC administered contactless delivery of energy efficiency kits to areas where a previous neighborhood sweep had been completed. Customers who were solicited but did not participate in the Core component in PY9 (i.e., declined or were not home) were eligible to receive the kits and received free delivery of a kit in PY10. Honeywell staff followed COVID-19 safety protocols and wore personal protective equipment while delivering/dropping off kits without entering customers' homes. Each kit included one kitchen faucet aerator and five LEDs (one 40 W equivalent, three 60 W equivalents, and one 100 W equivalent).

Additional Education

For both the Core and energy efficiency kits, customers also received a list of tips for saving energy, which encouraged them to take additional energy conservation actions. Table 43 presents the recommended energy conservation actions.

Table 43. NEEP Recommended Energy Conservation Actions ^a

Recommended Measure
Set thermostat at 68° F or lower in the winter and 78° F or higher in the summer
Install a smart thermostat
Replace air filters
Leave interior doors open and keep vents open for adequate air flow
Repair ducts
Have central heating and cooling system serviced
Upgrade attic insulation to a minimum of R-38
Caulk, seal, and weather-strip windows or doors
Adjust water heater temperature to 120° F
Replace incandescent lamps with EnergyWise LEDs
Unplug appliances, lights, TVs, computers, etc. when not in use

^a. The list also recommended visiting DESC's website or calling DESC. Information about Heating and Cooling Rebates, the Appliance Recycling Program, and the EnergyWise Savings Store was also included in the leave-behind materials.

3.6.2 Program Performance Summary

In PY10, the program fell short of participation targets (44%) as well as energy (19%) and demand (17%) savings forecasts. The COVID-19 pandemic caused DESC to pause for most of the year, which disrupted usual program implementation and reduced participation. DESC not only paused the core program but was also unable to offer the mobile home weatherization component at all in PY10. In addition, the energy efficiency kits included fewer measures than the Core component, which resulted in lower savings. Finally, the savings forecasts did not account for the application of ISRs.⁵ Program implementation staff delivered kits directly to participants or dropped off the kits outside participants' homes, so customers were responsible for installing the measures. This resulted in much lower ISRs compared to the Core component. Table 44 summarizes the forecasted and actual performance in terms of costs, participation, and energy and demand savings.

⁵ ISRs represent the "persistence rate" for Core component measures and ISRs for kit measures. Persistence rates and ISRs effectively represent the same metric: the percentage of measures currently installed. However, industry-standard nomenclature for this concept often differs between direct install (persistence rate) and non-direct install (ISR) measures.

Table 44. NEEP Forecasts and Results

Metric	Forecast	Actual	% of Forecast Accomplished
Cost	\$958,088	\$386,013	40%
Participants	4,243	1,883	44%
Gross MWH	4,975	952	19%
Gross MW	0.56	0.09	17%
Net MWH	N/A	952	N/A
Net MW	N/A	0.09	N/A

Note: Values rounded for reporting purposes.

While DESC was able to complete some neighborhood sweeps early in PY10, and served 740 homes through the Core component, more than half of participants received energy efficiency kits after the COVID-19-related shutdown (Table 45).

Table 45. NEEP Participation by Program Type

Component	Number of Participants	% of Total Participants
Energy Efficiency Kits	1,143	61%
Core	740	39%
Total program participants	1,883	100%

The Core component provided seven different types of measures for customers. DESC installed measures based on customer need and, on average, customers received four of the seven available direct install measures. Almost all customers received LEDs (99%) and advanced power strips (96%); and the majority of customers (87%) received HVAC filters (either packs of 12 standard size filters or two custom-cut filters). Four customers participated in the Core component (i.e., received the home walkthrough) but did not accept any measures. All customers who received an energy efficiency kit received five LEDs and one faucet aerator in the kit. Table 46 presents the total number of measures the program provided by component and the number of customers that received each type of measure.

Table 46. NEEP Participation by Component and Measure

Measure ^a	Program Participants	% of Total Component Participants	Total Measures Distributed in PY10 ^a	Unit
Core (N=740)				
LEDs	730	99%	8,786	Lamps
Advanced power strips	712	96%	712	Strips
HVAC filters	643	87%	7,538	Filters
Kitchen faucet aerators	351	47%	351	Aerators
Water heater blankets	194	26%	194	Blankets
Water heater pipe wrap	121	16%	504	Feet
Water heater temperature adjustment	19	3%	19	Adjustments
Energy Efficiency Kits (N=1,143)				
LEDs	1,143	100%	5,715	Lamps
Kitchen faucet aerators	1,143	100%	1,143	Aerators
Total	1,883	100%	24,962	N/A

^a Total measures distributed does not account for ISRs.

3.6.3 Impact and Data-Tracking Findings

The Evaluation Team performed a thorough review of the program databases and found no duplicative records or data tracking errors. The team then applied ISRs to the ex-ante measure quantities to determine ex-post quantities.

In-Service Rates

Most ISRs for Core component measures are from PY5 evaluation results. However, for two Core measures that DESC introduced in PY7, LEDs and kitchen faucet aerators, the Evaluation Team applied a 100% ISR as these measures have not yet been evaluated. Previous NEEP evaluation efforts resulted in a 99.9% ISR for CFLs, therefore a 100% ISR for LEDs is a reasonable assumption pending further validation efforts. The team plans to conduct a participant survey in PY11 to develop ISRs for these measures.

The Evaluation Team fielded a phone survey with energy efficiency kit recipients to develop ISRs for LEDs and kitchen faucet aerators, and found ISRs of 51% and 24%, respectively. While the ISRs for both measures are lower than the direct install ISRs for the same measures, lower rates are to be expected given the delivery/drop-off design of the kit component; customers install the measures with limited education or instruction; and there is no way to check whether the aerators are compatible with the customers' faucets. Appendix E contains more detail on ISR calculations.

Table 47 presents the ISRs the Evaluation Team applied to each measure and the resulting ex-post measure quantities.

Table 47. NEEP Ex-Ante and Ex-Post Measure Quantity

Measure	Ex-Ante Measure Quantity	ISR	Ex-Post Measure Quantity	Unit
Core				
LEDs	8,786	100%	8,786	Lamps
HVAC filters	7,538	100%	7,538	Filters
Advanced power strips	712	93%	662	Strips
Water heater pipe wrap	504	94%	474	Feet
Kitchen faucet aerators	351	100%	351	Aerators
Water heater blankets	194	92%	178	Blankets
Water heater temperature adjustment	19	100%	19	Adjustments
<i>Core subtotal</i>	<i>18,104</i>	<i>N/A</i>	<i>18,008</i>	<i>N/A</i>
Energy Efficiency Kits				
LEDs	5,715	51%	2,915	Lamps
Kitchen faucet aerators	1,143	24%	274	Aerators
<i>Energy efficiency kits subtotal</i>	<i>6,858</i>	<i>N/A</i>	<i>3,189</i>	<i>N/A</i>
Program Total	24,962	N/A	21,197	N/A

Total Program Ex-Post Gross Impacts

The Evaluation Team reviewed the program-tracking database to verify the appropriate application of deemed savings values. The team did not find any discrepancy in the deemed savings values for any measure. However, the team developed updated deemed savings values for kitchen faucet aerators based on PY10 survey results. The survey found that 62% of the respondents (n=97; excluding invalid responses) had electric water heating and 10% of respondents who installed their aerators (n=29) installed them in a bathroom instead of the kitchen. Both factors reduced energy efficiency kit faucet aerator savings (125.16 KWH and 0.006 KW) compared to the Core component (225.00 KWH and 0.011 KW). Table 48 shows the per-unit deemed savings for all program measures.

Table 48. NEEP Per-Unit Deemed Savings Values

Measure	Unit	Per-Unit Savings	
		KWH	KW
Core			
LED 40W equivalent	Per lamp	37.23	0.003
LED 60W equivalent	Per lamp	54.75	0.005
LED 75W equivalent	Per lamp	68.99	0.006
LED 100W equivalent	Per lamp	94.17	0.009
HVAC filters (electric heating & cooling)	Per participant	64.00	0.015
HVAC filters (electric cooling only)	Per participant	32.00	0.018
HVAC filters (electric heating only)	Per participant	32.00	0.000
Kitchen faucet aerator	Per aerator	225.00	0.011
Water heater pipe wrap	Per foot	13.72	0.002
Advanced power strips	Per strip	102.80	0.012
Water heater blanket	Per blanket	360.80	0.041
Water heater temperature adjustment	Per adjustment	113.84	0.013
Energy Efficiency Kits Measures			
LED 40W equivalent	Per lamp	37.23	0.003
LED 60W equivalent	Per lamp	54.75	0.005
LED 100W equivalent	Per lamp	94.17	0.009
Kitchen faucet aerator	Per aerator	125.16	0.006

As shown in Table 49, the NEEP program achieved ex-post gross savings of 952 MWH and 0.09 MW. While it represented a little over a third of participation (39%), the Core component achieved significantly more savings per-participant compared to the energy efficiency kits; accounting for 78% of program ex-post energy savings and 81% of demand savings. For the program overall, LEDs were the largest contributor to ex-post gross energy savings (70%), followed by kitchen faucet aerators (12%). The overall realization rates for the program are 0.70 for MWH and 0.77 for MW savings. The discrepancy between ex-ante and ex-post savings is primarily due to the application of ISRs; as well as the updated deemed savings value for the kitchen faucet aerator included in the energy efficiency kits.

Table 49. NEEP Ex-Post Gross Savings Summary

Measure	Ex-Ante Gross		Ex-Post Gross		Gross Realization Rate	
	MWH	MW	MWH	MW	MWH	MW
Core						
LEDs	493	0.045	493	0.045	1.00	1.00
HVAC filters	33	0.010	33	0.010	1.00	1.00
Advanced power strips	73	0.009	68	0.008	0.93	0.93
Water heater pipe wrap	7	0.001	6	0.001	0.94	0.94
Water heater blankets	70	0.008	64	0.007	0.92	0.92
Kitchen faucet aerators	79	0.004	79	0.004	1.00	1.00
Water heater temperature adjustment	2	0.000	2	0.000	1.00	1.00
<i>Core subtotal</i>	757	0.08	746	0.08	0.99	0.98
Energy Efficiency Kits						
LEDs	338	0.031	172	0.016	0.51	0.51
Kitchen faucet aerators	257	0.013	34	0.002	0.13	0.13
<i>Energy Efficiency Kits subtotal</i>	595	0.04	207	0.02	0.35	0.40
Program Total	1,352	0.12	952	0.09	0.70	0.77

Note: Values rounded for reporting purposes.

Net Impacts

The Evaluation Team applied an NTGR of 1.0 to determine ex-post net savings, which is a common assumption when evaluating low-income programs; most customers are highly unlikely to install these measures or take additional action without the program due to income constraints. As a result, the ex-post net savings are identical to the ex-post gross savings of 952 MWH and 0.09 MW (Table 50).

Table 50. NEEP Net Savings Impacts

Ex-Post Gross		NTGR		Ex-Post Net	
MWH	MW	MWH	MW	MWH	MW
952	0.09	1.00	1.00	952	0.09

3.7 Multifamily Program

The Multifamily program is a new offering that provides multifamily properties with no-cost direct install measures in tenant units and incentivized (75% of cost) common area energy efficient upgrades. Technicians perform an on-site energy audit of the building and provide customers with direct-install measures. During the energy audit, technicians will recommend additional energy efficiency improvements, such as HVAC upgrades, LED lighting, and water conservation measures for common areas. Due to the COVID-19 pandemic, DESC delayed implementation until late September, focused on common area upgrades only, and completed upgrades for one property in PY10.

3.7.1 Program Performance Summary

Table 51 summarizes program performance compared to forecasts. Due to the late program launch, the program did not meet its participation or savings forecasts. Note, participation (projects) reflects the number

of units and common areas served, rather than the number of unique properties served. As such, while only completing one project was the main driver for performance, DESC's decision not to enter tenant units during COVID-19 also contributed to lower-than-expected participation.

Table 51. Multifamily Forecast and Results

Metric	Forecast	Actual	% of Forecast
Program cost	\$830,140	\$100,028	12%
Participation (projects)	1,358	1	0.07%
Gross MWH	2,641	4	0.17%
Gross MW	0.40	0.001	0.31%
Net MWH	N/A	4	N/A
Net MW	N/A	0.001	N/A

Table 52 below lists the measures the program provided in one common area project in PY10.

Table 52. Multifamily Measure Quantities

Measure	Count	Units
9.5 W LED	13	Lamps
14 W LED	2	Lamps
ASHP	1	Systems
Duct sealing	1	Projects
Programmable thermostat	1	Thermostats
Kitchen faucet aerator	1	Aerators
Total	19	Measures

3.7.2 Impact and Data Tracking Findings

Database Review

The Evaluation Team reviewed the program tracking database and found that all ex-ante savings aligned with planning assumptions (Table 53). Thus, no adjustments to ex-ante measure quantities or ex-ante savings were needed.

Table 53. Multifamily Database Review Adjustments

Measure Category	Ex-Ante Gross		Revised Ex-Ante Gross		Tracking Accuracy	
	KWH	KW	KWH	KW	KWH	KW
LED lighting	2,579	0.58	2,579	0.58	100%	100%
ASHP	2,119	0.59	2,119	0.59	100%	100%
Duct sealing	978	0.35	978	0.35	100%	100%
Programmable thermostat	128	0.05	128	0.05	100%	100%
Kitchen faucet aerator	69	0.01	69	0.01	100%	100%
Total	5,873	1.57	5,873	1.57	100%	100%

Note: Some values in this table do not sum or divide exactly due to rounding.

Ex-Post Savings Adjustments

The Multifamily program achieved ex-post gross savings of 4 MWH and 0.001 MW, resulting in gross savings realization rates of 0.76 for MWH and 0.79 for MW. The ASHP replacement, LED lighting upgrades, and duct sealing represented the vast majority of ex-post gross savings (96% of KWH savings); lighting upgrades alone represented 60% of ex-post gross KWH savings. DESC's ex-ante savings aligned with planning assumptions, however, the Evaluation Team developed ex-post savings based on actual project characteristics. While all ex-post savings estimates differed from ex-ante, the primary driver of the overall program realization rates was differences in savings assumptions for the ASHP replacement. The existing unit was five years old⁶ and the efficiency was equivalent to federal minimum standards. Ex-ante estimates used early retirement savings assumptions because the existing unit was still operating. However, early retirement savings assume much older units and lower baseline efficiencies. Since the existing unit was less than five years ago and equivalent to the Federal minimum standard, the actual savings is much lower than the original assumption; equivalent to time-of-sale savings even though the unit was still operating. Additionally, while it was a relatively minor contributor to overall savings, the low-flow kitchen faucet aerator savings also had realization rates significantly lower than 100% because the flowrate of the aerator was higher than planning estimates assumed; 2.0 gallons per minute (GPM) instead of 1.5 GPM.

Table 54. Multifamily Ex-Post Gross Savings Summary Measure Category

Measure	Ex-Ante Gross		Realization Rate		Ex-Post Gross		Summary of Ex-Post Adjustments
	KWH	KW	KWH	KW	KWH	KW	
LED lighting	2,579	0.58	1.04	0.99	2,684	0.58	<ul style="list-style-type: none"> Revised waste heat factors to use values for actual heat type (heat pump) instead of unknown electric heating type.
ASHP	2,119	0.59	0.27	0.44	574	0.26	<ul style="list-style-type: none"> Used existing and efficient equipment specifications (SEER, HSPF, EER, heating capacity) from project documentation.
Duct sealing	978	0.35	1.02	1.02	996	0.35	<ul style="list-style-type: none"> Used actual duct leakage test results from project documentation. Use existing HVAC equipment specifications from project documentation.
Programmable thermostat	128	0.05	0.99	1.00	126	0.05	<ul style="list-style-type: none"> Revised heating capacity to align with project documentation.
Kitchen faucet aerator	69	0.01	0.85	0.55	59	0.01	<ul style="list-style-type: none"> Increased existing flow rate (GPM) assumption to align with the standard in effect when building was built (in 1986). Increased efficient flow rate based on project documentation (2.0 GPM).
Total	5,873	1.57	0.76	0.79	4,440	1.24	

⁶ The serial number for the removed equipment indicates a manufactured date of December 2017.

Net Savings

As shown in Table 55, the Multifamily program achieved 4 MWH and 0.001 MW in ex-post net savings. To arrive at ex-post net savings for PY10, the Evaluation Team applied an NTGR of 1.0 to ex-post gross savings. The team will develop an evaluated NTGR once sufficient participation has occurred.

Table 55. Multifamily Ex-Post Net Savings Summary

Measure Category	Ex-Post Gross		NTGR		Ex-Post Net	
	KWH	KW	KWH	KW	KWH	KW
LED lighting	2,684	0.58	1.00	1.00	2,684	0.58
Duct sealing	996	0.35	1.00	1.00	996	0.35
ASHP	574	0.26	1.00	1.00	574	0.26
Programmable thermostat	126	0.05	1.00	1.00	126	0.05
Kitchen faucet aerator	59	0.01	1.00	1.00	59	0.01
Total	4,440	1.24	1.00	1.00	4,440	1.24

3.8 EnergyWise for Your Business Program

3.8.1 Program Description

The EnergyWise for Your Business (EWfYB) Program offers incentives to eligible C&I customers in DESC's electric service area to encourage installation of high-efficiency equipment and building improvements that reduce energy costs. On-site work was temporarily suspended from March to June 2020 due to COVID-19, with virtual inspections and outreach processes developed to keep program activities running during the pandemic. The program, implemented with the support of ICF, includes both prescriptive and custom incentives. At the close of PY10, 407 large C&I accounts, representing approximately 22% of DESC's retail electric load, remained opted-out of DESC's Demand Side Management programs.

3.8.2 Program Performance Summary

Table 56 shows the program's PY10 performance in comparison to the forecast. Despite spending and participation at roughly half of forecasts (largely the result of a six-month pause in on-site and in-person outreach due to COVID-19)⁷, electric and demand savings came closer to targets, achieving 83% and 67%, respectively. At the project -level, the program exceeded forecasts, with average forecasted savings per project at 41.6 MWH and 0.01 MW compared to ex-post average savings at 72.21 MWH and 0.014 MW.

⁷ While the program continued with virtual outreach during this six-month period, the virtual outreach events slowed down significantly and do not have the same impact on enrollment as in-person outreach.

Table 56. EWfYB Forecasts and Results

Metric	Forecast	Actual	% of Forecast
Program cost	\$8,034,116	\$4,321,733	54%
Participation (projects)	891	428	48%
Gross MWH	37,076	30,904	83%
Gross MW	8.75	5.89	67%
Net MWH	N/A	22,251	N/A
Net MW	N/A	4.42	N/A

Table 57 summarizes the share of ex-post gross savings by application type. As with previous years, prescriptive lighting measures, including prescriptive new construction lighting, continue to drive program savings, accounting for 92% and 95% of ex-post gross energy and demand savings, respectively. Combined, prescriptive non-lighting and custom measures account for 8% and 5% of ex-post gross energy and demand savings, respectively.

Table 57. EWfYB Savings by Application Type

Application Type	Number of Projects	% of Ex-Post MWH	% of Ex-Post MW
Prescriptive Lighting			
Lighting	373	91%	93%
New construction	12	1%	1%
<i>Prescriptive lighting subtotal</i>	385	92%	95%
Prescriptive Non-Lighting and Custom			
Custom incentives	12	6%	3%
Prescriptive unitary HVAC	16	1%	1%
Prescriptive chillers	9	1%	1%
Prescriptive Variable-Frequency Drives (VFDs)	3	0%	0%
Prescriptive food service	3	0%	0%
<i>Prescriptive Non-Lighting and Custom subtotal</i>	43	8%	5%
Total	428	100%	100%

3.8.3 Impact and Data-Tracking Findings

The impact evaluation involved multiple steps in quantifying ex-post gross and net savings. The first step confirmed that DESC's reported ex-ante savings matched the sum of tracked savings for each project in the database. The Evaluation Team then reviewed the program tracking database to ensure there were no duplicate records, that all PY10 projects were completed within the program year (December 2019 through November 2020), and that there were no missing data (e.g., ex-ante savings, quantities, and incentives). Next, the Evaluation Team performed desk reviews on a sample of projects to assess accuracy and completeness of ex-ante tracking against project documentation and developed ex-post gross savings. Lastly, the Evaluation Team applied the program NTGR to estimate ex-post net savings. The applied NTGR is the value used in PY10 program planning and used in the EWfYB evaluation since PY7.

Database Review

The Evaluation Team did not find any tracking errors when reviewing the program-tracking database and, therefore, did not adjust ex-ante savings as shown in Table 58.

Table 58. EWfYB Database Review Adjustments

Application Type	Reported Ex-Ante Gross		Revised Ex-Ante Gross		Tracking Accuracy	
	MWH	MW	MWH	MW	MWH	MW
Prescriptive lighting	28,241	5.56	28,241	5.56	100%	100%
Custom incentives	1,828	0.19	1,828	0.19	100%	100%
Prescriptive unitary HVAC	218	0.06	218	0.06	100%	100%
Prescriptive chillers	193	0.04	193	0.04	100%	100%
Prescriptive Variable-Frequency Drives (VFDs)	105	0.02	105	0.02	100%	100%
Prescriptive food service	36	0.01	36	0.01	100%	100%
Prescriptive new construction lighting	395	0.08	395	0.08	100%	100%
Total	31,017	5.96	31,017	5.96	100%	100%

Note: Some values in this table do not sum or divide exactly due to rounding.

Project Desk Reviews

The Evaluation Team conducted engineering desk reviews on sampled projects across each of the different application types within the EWfYB program. Using interim data received in September 2020, the team developed a stratified random sample for prescriptive lighting and a simple random sample for new construction lighting, custom, and prescriptive new construction lighting application types.⁸ The team developed realization rates at the sampled project level and then weighted the sampled projects by savings to establish population-level realization rates. The team then applied the population-level realization rates for each application type to ex-ante savings resulting in the development of ex-post gross savings.

Table 59 provides a comparison of ex-ante and ex-post gross savings. Notably, the Prescriptive Non-Lighting application type is a combination of prescriptive unitary HVAC, prescriptive HVAC chillers, prescriptive food service, and prescriptive VFD measures. The energy (MWH) and demand (MW) realization rates for the EWfYB program are 1.00 and 0.99, respectively.

Table 59. EWfYB Ex-Post Gross Savings Summary

Application Type	Ex-Ante		Ex-Post		Gross Realization Rate	
	MWH	MW	MWH	MW	MWH	MW
Prescriptive lighting	28,241	5.56	28,241	5.56	1.00	1.00
Custom incentives	1,828	0.19	1,647	0.13	0.90	0.68
Prescriptive non-lighting	552	0.12	621	0.11	1.12	0.91
Prescriptive new construction lighting	395	0.08	395	0.08	1.00	1.05
Total	31,017	5.96	30,904	5.89	1.00	0.99

Note: Some values in this table do not sum or divide exactly due to rounding.

Summary of Ex-Ante and Ex-Post Discrepancies

⁸ Upon receipt of the final tracking data, the Evaluation Team opted to sample one additional custom project with 534,600 KWH reported savings (roughly 30% of total ex-ante custom program savings) for review.

For all sampled prescriptive projects, the team applied algorithms and assumptions from the DESC Commercial Energy Algorithm Manual (CEAM) to develop ex-post savings at the measure-level.⁹ For all sampled custom projects, the team conducted an in-depth review of project documents and ex-ante savings analysis files, and then used various methods to validate ex-ante savings and develop ex-post savings. These methods varied based on project type and information available and are detailed in Appendix F.

Table 60 summarizes the key reasons for differences between ex-ante and ex-post savings by application type. More detail is provided in Appendix F.

Table 60. EWfYB Summary of Differences Between Ex-Ante and Ex-Post Estimates

Application Type	Gross Realization Rate		Reason for Difference
	MWH	MW	
Prescriptive lighting	1.00	1.00	None
Custom incentives	0.90	0.68	<ul style="list-style-type: none"> Guestroom HVAC Controls (4 Projects): The ex-ante savings methods differ from ex-post. See Appendix F for ex-post method details. New Construction Exterior Lighting (1 Project): Ex-ante demand savings applied a coincidence factor of 1.0; ex-post demand savings applied the CEAM-recommended exterior lighting coincidence factor 0.28 to ex-ante demand savings. This project represented 43% of total ex-ante and, after applying the coincidence factor of 0.28, 18% of total ex-post demand savings in the custom sample. Chiller Replacement (1 Project): Ex-ante demand savings applied a coincidence factor of 1.0; ex-post demand savings applied the CEAM-recommended chiller coincidence factor of 0.80. This project represented 16% of total ex-ante and, after applying the coincidence factor of 0.28, 18% of total ex-post demand savings in the custom sample.
Prescriptive non-lighting	1.12	0.91	For Unitary HVAC and Chillers (present in 6 out of 12 sampled prescriptive non-lighting projects), ex-ante baseline efficiencies did not align with the CEAM-specified minimum baseline efficiencies.
Prescriptive new construction lighting	1.00	1.05	Ex-ante savings estimates applied generalized (average) coincidence factors; ex-post savings estimates used CEAM-recommended, building-type specific coincidence factors.

Net Savings

Table 61 shows the PY10 ex-post net energy and demand savings. The Evaluation Team applied PY6-evaluated NTGRs, which have been used in the evaluation since PY7, to the PY10 ex-post gross savings values to determine ex-post net savings.

Table 61. EWfYB Ex-Post Net Savings Summary

Ex-Post Gross		NTGR		Ex-Post Net	
MWH	MW	MWH	MW	MWH	MW
30,904	5.89	0.72	0.75	22,251	4.42

⁹ Dominion Energy South Carolina Commercial Energy Algorithm Manual, June 2019.

3.9 Small Business Energy Solutions

3.9.1 Program Description

DESC created the Small Business Energy Solutions (SBES) Program to target a subsegment of the market that was underserved in the EWfYB Program. SBES participation is restricted to small businesses or nonprofits who have five or fewer DESC electric accounts and annual energy usage of less than 350,000 KWH.

The program offers a no-cost, on-site energy analysis of lighting and/or refrigeration, as well as incentives for lighting and refrigeration equipment. Notably, on-site energy analyses were temporarily suspended from March to June 2020 due to COVID-19. DESC developed a virtual inspection process to continue with projects that were in the queue before the pandemic began. On-site work resumed to a limited degree in the latter half of the program year (effective June 22, 2020), but virtual inspections continue to reduce the number of in-person interactions. While the SBES Program offers fewer measures than EWfYB, DESC offers higher financial incentives to address the cost barriers often faced by small businesses. Halfway through the program year, DESC increased its incentive level from 80% to 90% of the pre-tax project costs, or up to \$6,000 per utility account per program year.

ICF administers the program and subcontracts to Facility Solutions Group (FSG) for lighting measures and National Resource Management (NRM) for refrigeration measures. ICF, FSG, and NRM use local service providers, or contractors, to perform installations.

3.9.2 Program Performance Summary

Table 62 shows the program's PY10 performance in comparison to the forecast. The PY10 program exceeded cost and participation forecasts but fell slightly short of forecasted savings. The key driver of lower savings was primarily due to a misalignment between actual installed lighting savings and the estimated lighting abandonment rate assumption in the forecast.¹⁰ Although program staff increased the budget to boost the number of participants, they were unable to fully make-up for the anticipated shortfall in savings due to the aforementioned reasons, as well as the four-month pause in new SBES projects as a result of COVID-19.

Table 62. SBES Forecasts and Results

Metric	Forecast	Actual	% of Forecast
Cost	\$1,640,965	\$3,052,049	186%
Participation (projects)	678	754	111%
Gross MWH	8,718	7,036	81%
Gross MW	2.48	2.28	92%
Net MWH	N/A	6,731	N/A
Net MW	N/A	2.23	N/A

Participant Overview

The majority (94%) of ex-ante energy savings come from lighting projects, while refrigeration measures account for the remaining 6% of energy savings. Twelve types of business segments participated in the program. Retail, offices, and warehouse facilities were the highest contributing segments to ex-ante savings. When compared

¹⁰ Abandonment rate refers to the proportion of old fixtures that will be retired completely because LEDs can provide the same amount of lighting with fewer fixtures. High abandonment rate assumptions fail to account for the 'rebound effect,' whereby reductions in the cost of LEDs result in increased energy consumption as people use more and more lights.

to the previous program year, increases in participation were seen for Office, Religious Facility, Warehouse and School building segments. Table 63 lists each segment with associated participation levels and savings.

Table 63. SBES Participation and Savings by Segment

Segment	Number of Projects	Ex-Ante		% of Ex-Ante	
		MWH	MW	MWH	MW
Lighting	706	6,516	1.78	94%	99%
Retail	231	1,993	0.59	29%	33%
Office	199	1,803	0.51	26%	28%
Warehouse	51	545	0.15	8%	8%
Religious Facility	60	514	0.16	7%	9%
Health Facility	42	445	0.12	6%	6%
Other	57	386	0.09	6%	5%
Restaurant	23	244	0.05	4%	3%
Grocery	12	227	0.03	3%	2%
Industrial Processing	15	177	0.05	3%	3%
School	14	160	0.03	2%	1%
University	1	17	0.004	<1%	<1%
Lodging	1	5	0.00	<1%	N/A
Refrigeration	48	391	0.02	6%	1%
Retail	30	284	0.02	4%	1%
Restaurant	18	107	0.01	2%	<1%
Total	754	6,907	1.80	100%	100%

Note: Some values in this table do not sum or divide exactly due to rounding.

3.9.3 Impact and Data-Tracking Findings

The SBES evaluation included multiple steps to estimate ex-post savings, identical to those detailed above in the EWfYB Program section.

Database Review

The Evaluation Team reviewed the program tracking database to check for duplicate records and other tracking errors. The team did not find any duplicate records in the tracking database. However, the team identified eight total records reporting zero energy and demand savings, although their catalog name suggested they were energy savings measures (e.g., LED Linear, LED Exit Sign, and LED Fixture). Through discussions with DESC, Opinion Dynamics confirmed that six out of the eight total records were mislabeled incentive adjustments and could be ignored in the evaluation. Of the remaining two records, DESC confirmed one record to have correctly reported zero energy and demand savings, while the other record with zero reported savings was the result of user error. DESC addressed the user error by providing revised total savings estimates which increased total program ex-ante savings by approximately 0.01%, as shown in Table 64.¹¹

¹¹ All further ex-ante gross savings totals displayed in the SBES chapter are equivalent to the revised ex-ante gross totals in Table 64.

Table 64. SBES Database Review Adjustments

Measure Category	Ex-Ante Gross		Revised Ex-Ante Gross		% Difference	
	MWH	MW	MWH	MW	MWH	MW
Lighting	6,515.8	1.7812	6,516.0	1.7813	0.002%	0.001%
Refrigeration	391.0	0.0231	391.0	0.0231	0.000%	0.000%
Total	6,906.8	1.8043	6,907.0	1.8044	0.002%	0.001%

Note: Some values in this table do not sum or divide exactly due to rounding.

Project Desk Reviews

The Evaluation Team conducted engineering desk reviews on a stratified random sample of 25 and 10 projects from the lighting and refrigeration measure categories, respectively. The team developed realization rates at the sampled project level and then weighted the sampled projects by savings to establish population-level realization rates. The team then applied the population-level realization rates for each measure category to ex-ante savings resulting in the development of ex-post savings. The energy (MWH) and demand (MW) realization rates for the SBES program are 1.02, and 1.26, respectively. Table 65 provides a comparison of ex-ante gross and ex-post gross savings by measure category.

Table 65. SBES Ex-Post Gross Savings Summary

Measure Category	Ex-Ante Gross		Ex-Post Gross		Gross Realization Rate	
	MWH	MW	MWH	MW	MWH	MW
Lighting	6,516	1.78	6,645	2.22	1.02	1.25
Refrigeration	391	0.02	391	0.05	1.00	2.29
Total	6,907	1.80	7,036	2.28	1.02	1.26

Note: Some values in this table do not sum or divide exactly due to rounding.

For all sampled projects, the Evaluation Team applied algorithms and assumptions from the DESC CEAM¹² to develop ex-post savings. Lighting realization rates greater than 1.0 are driven by the application of the CEAM-aligned coincidence and waste heat factors to ex-post calculations, which the ex-ante estimates do not account for. Additionally, the building type used in ex-ante calculations was adjusted in ex-post calculations for certain projects based on desk review findings. For the refrigeration measure category, the high KW realization rate is due to the exclusion of ex-ante demand savings for *Novelty Cooler Night Setback* measures in the program tracking data. The team applied CEAM algorithms to estimate ex-post demand savings in the sample of 10 refrigeration projects. This resulted in an additional savings of 10.5 KW over ex-ante, representing 70% of ex-post demand savings in the refrigeration sample. Additional detail by end-use is provided in Appendix H.

¹² Dominion Energy South Carolina Commercial Energy Algorithm Manual, June 2019.

Net Savings

As shown in Table 66, the SBES Program achieved 6,731 MWH and 2.23 MW in ex-post net savings. To arrive at ex-post net savings, the Evaluation Team applied PY5-evaluated NTGRs for lighting and PY8-evaluated NTGRs for refrigeration to ex-post gross savings.

Table 66. SBES Ex-Post Net Savings Summary

Measure Category	Ex-Post Gross		NTGR		Ex-Post Net	
	MWH	MW	MWH	MW	MWH	MW
Lighting	6,645	2.22	0.96	0.98	6,379	2.18
Refrigeration	391	0.05	0.90	0.89	352	0.05
Total	7,036	2.28	0.96	0.98	6,731	2.23

Appendix A. PY10 Survey Response Rates and Representativeness

The table below describes the survey methodology and representativeness across all surveys fielded for PY10 evaluation. These surveys provided the data needed to calculate NTGR and/or ISRs for several programs.

Table 67. PY10 Survey Methods and Response Results

Program Component	Target	Population Size	Sample Size	Number of Responses	Sampling Method	% of Population in Survey Results
EnergyWise Savings Store - Online Store Channel	Participating customers	7,120	4,700	655	To reduce respondent burden, the team selected one measure for each respondent to consider, prioritizing the least common measures in cases where customers purchased multiple. The team use a census approach for water-saving measures and a simple random sample of up to 1,000 customers for each of standard LEDs, reflector LEDs, specialty LEDs, advanced power strips, and smart thermostats.	9.2%
NEEP Energy Efficiency Kits	Kit recipients	1,143	1,088	105	Census attempt of customers with a valid phone contact information	9.2%

Appendix B. EnergyWise Savings Store Detailed Methods

This appendix provides additional information on the evaluation methods for the PY10 EnergyWise Savings Store program. It begins with a discussion of the methods for developing deemed savings values for lighting and non-lighting products, followed by a summary of the substantive differences (i.e., non-rounding issues) between per-unit deemed ex-ante and ex-post savings. This is followed by a comparison of total ex-ante and revised gross savings for all product types in the program.¹³ This appendix concludes with detailed methods for calculating carryover savings, lighting and non-lighting measure ISRs, and non-lighting measure NTGRs.

Detailed Methods for Deemed Savings Evaluation

In PY10, the Evaluation Team evaluated per-unit savings for 90 new products: 59 newly introduced LED lighting products, 18 new advanced thermostats, eight new water-saving products (showerheads and faucet aerators), three new advanced power strips, a smart socket, and a smart bundle containing two LED bulbs and two smart sockets. The team also reviewed per-unit savings for 40 previously offered LED lighting, advanced power strip, and water-saving products. The following sections outline the methods used to calculate savings for each measure type.

Lighting Deemed Savings Estimation

Equation 1 and Equation 2 provide the formulas the Evaluation Team used to estimate per-unit energy and demand savings for new lighting products.

Equation 1. Lighting Revised Gross Energy Savings Formula

$$KWh\ Savings = (HOU \times 365) \times (W_{Base} - W_{EE}) \times WHFe/1000$$

Equation 2. Lighting Revised Gross Demand Savings Formula

$$KW\ Savings = (W_{Baseline} - W_{EE}) \times WHFd \times CF/1000$$

Where:

<i>KWh Savings</i>	= First-year energy savings
<i>KW Savings</i>	= First-year peak demand savings
<i>HOU</i>	= Average hours of use per day
<i>W_{Base}</i>	= Baseline wattage
<i>W_{EE}</i>	= Wattage of the energy-efficient replacement
<i>WHFe</i>	= Waste heat factor for energy use, accounts for the effects of more efficient lighting on cooling energy use
<i>WHFd</i>	= Waste heat factor for demand, accounts for the effects of more efficient lighting on cooling energy demand
<i>CF</i>	= Coincidence factor

¹³ Note, one "measure type" may contain multiple "products" (defined by product ID), such as different brands of the same type and wattage of LED.

Baseline Wattage

Traditionally, the baseline wattage for energy-efficient products has been an incandescent light bulb. However, the provisions of the 2007 EISA rulings have gradually increased the efficiency requirements of general service incandescent light bulbs. The regulations were phased in over several years, affecting 100 W general service incandescent bulbs in January 2012, 75 W incandescent bulbs in January 2013, and 60 W and 40 W incandescent bulbs in January 2014. Manufacturers responded to EISA by developing halogen bulbs that meet the new efficiency standards. These new “EISA-compliant” halogens ultimately replaced incandescent lamps as the efficient baseline for calculating program savings; affected incandescent lamp wattages are now assumed to be virtually non-existent on store shelves. A second phase of the legislation was set to take effect on January 1, 2020, setting an efficiency standard of 45 lumens per watt across nearly all screw-based products commonly used in residential applications. Through a series of rules and determinations issued throughout 2019, however, the Department of Energy (DOE) effectively rolled back the enactment of these standards.

The Evaluation Team cross-referenced product descriptions with assigned wattages, baseline wattages and lumen ranges, then assigned final baseline wattages based on verified lumen counts. Table 68 provides the post-EISA 2007 baseline wattage by lumen range that the Evaluation Team applied for new standard products.

Table 68. Online Store: Baseline Wattages for Standard Bulbs

Lumen Range	Incandescent-Equivalent Wattage	Post-EISA Baseline Wattage
250–309	<40	25
310–749	40	29
750–1,049	60	43
1,050–1,489	75	53
1,490–2,600	100	72
2,601–2,999	150	150
3,000–5,279	200	200
5,280–6,209	300	300

In addition to general service products, certain directional lighting products (i.e., “reflectors”) are subject to DOE energy efficiency standards that went into effect at the beginning of 2012.¹⁴ The legislation affected directional LEDs depending on the bulb type and lumen range. As a result, the Evaluation Team applied the following baseline wattages for new directional LED products.

Table 69. Online Store: Baseline Wattages for Directional Bulbs

Reflector Bulb Type	Lumen Range	Reflector Bulb Baseline Wattage
R, PAR, ER, BR, BPAR, or similar bulb shapes with medium screw bases and diameter >2.5”	600–849	50
	850–999	55
	1,000–1,300	65
ER 30, BR 30, BR 40, ER 40	400–449	40
	450–499	45
	500–1,419	65
R 40	400–449	40
	450–719	45
All reflector lamps below the lumen ranges specified above	200–299	30
	300–399	40

Products exempt from both EISA and DOE legislation were assigned an incandescent baseline wattage based on verified lumen counts.

Efficient Product Wattage

The Evaluation Team used actual wattages of the new lighting products as specified by product manufacturers. The Evaluation Team performed internet lookups for any lighting products with inconsistent per-unit savings or inconclusive measures specifications recorded in program-tracking data.

Hours of Use and Coincidence Factor

The Evaluation Team used PY2-evaluated assumptions of 3.0 daily hours of use and a 0.10 coincidence factor.

Waste Heat Factors

The inclusion of waste heat factors for lighting is based on the concept that heating loads increase to supplement the reduction in heat that was once provided by incandescent lamps and cooling loads decrease since there is less heat output from the incandescent lamp that was once in place. The overall effects are complicated to determine, as they are influenced not just by the type of lighting used, but also by the climate and the type of HVAC systems used to heat and cool the home. Waste heat factors developed for one climate region cannot be used in another; the climate and the mix of heating and cooling use vary widely across the country. DESC currently does not have waste heat factor estimates that are specific to its territory and fuel mix. The Evaluation Team, therefore, used an energy and demand waste heat factor of 1.0.

¹⁴ Department of Energy. 10 CFR 430 Energy Conservation Program: Energy Conservation Standards and Test Procedures for General Service Fluorescent Lamps and Incandescent Reflector Lamps: Final Rule. July 2009.

Non-Lighting Deemed Savings Estimation

Non-lighting products offered in PY10 included advanced power strips, advanced thermostats, smart sockets, low-flow bathroom and kitchen faucet aerators, low flow showerheads, and thermostatic valves (TSV). To determine deemed savings for these measures, the Evaluation Team applied the most appropriate assumptions available based on review of the Illinois, Mid-Atlantic, and Indiana Technical Reference Manuals (TRMs), survey data from the DESC Market Potential Study, and South Carolina-specific temperature assumptions from the National Renewable Energy Lab (NREL). Table 70 summarizes the revised deemed savings values for new non-lighting measures sold through the Online Store channel.

Table 70. Online Store: PY10 Non-Lighting Revised Deemed Savings

Measure	KWH Per Unit	KW Per Unit
Advanced thermostat	458.51	0.1802
Advanced power strip (5+ plug)	56.50	0.0063
Advanced power strip (7+ plug)	103.00	0.0116
Smart socket	3.48	0.0006
Faucet aerator (1.0 GPM, bathroom)	15.44	0.0022
Faucet aerator (1.0 GPM, kitchen)	144.86	0.0033
Faucet aerator (1.0 GPM, unknown)	29.01	0.0021
Faucet aerator (1.5 GPM, bathroom)	7.07	0.0010
Faucet aerator (1.5 GPM, kitchen)	66.31	0.0033
Faucet aerator (1.5 GPM, unknown)	13.28	0.0010
Showerhead (1.5 GPM)	158.65	0.0086
Showerhead (1.5 GPM with TSV)	190.59	0.0154
Thermostatic valve	50.05	0.0068

Advanced Thermostats

Table 71 provides the formulas and parameters the team used to estimate per-unit energy and demand savings for advanced thermostats.

Table 71. Online Store Advanced Thermostat Savings Algorithms and Assumptions

Parameter	Assumption	Source and Notes
Algorithms		
KWH savings	= ((FLHcool*Btuhcool*1/SEER*%ElecCool_Savings)/1000) + ((FLHheat*Btuhheat*1/HSPF * %ElecHeat_Savings)/1000)	
KW savings	= Btuhcool * 1 / EER * %ElecCool_Savings * CF	
Parameters		
Baseline Type	Manual	
FLHcool	1582	Developed a ratio comparing CDDs for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Single-Family Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Cooling Hours for SF buildings in South Carolina.
Btuhcool	36000	If actual tonnage is unknown, assumes the average capacity from DESC PY9 HVAC & Duct Program of 3 ton (36000 Btuh).
SEER	14.00	Average efficiencies of new and removed HVAC equipment from DESC PY9 HVAC & Duct Program.
%ElecCool_Savings	7%	Mid-Atlantic TRM V9.0.
FLHheat	620	Developed a ratio comparing HDDs for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Single -Family Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Cooling Hours for SF buildings in South Carolina.
Btuhheat	36000	Average capacity from DESC PY9 HVAC & Duct Program.
HSPF	N/A	Blend of 3.41 for electric resistance and8.20 for ASHP.
%ElecHeat_Savings	6%	Mid-Atlantic TRM V9.0.
AFUE	0.80	
Central cooling weight	96%	DESC 2018 Market Baseline Study for Single-Family.
Gas heat weight	32%	DESC 2018 Market Baseline Study for Single-Family.
HP weight	31%	DESC 2018 Market Baseline Study for Single-Family. Applied RECs to determine electric heat split between heat pump and electric resistance for homes in South Atlantic.
Electric resistance weight	35%	DESC 2018 Market Baseline Study for Single-Family. Applied RECs to determine electric heat split between heat pump and electric resistance for homes in South Atlantic.
EER	11.76	Conversion from SEER.
CF	0.88	IN TRM V2.2. Based on Wisconsin TRM which has a peak period that spans 12 hours like that of DESC (10 a.m.–10 p.m.).

Advanced Power Strips

Table 72 provides the formulas and parameters the team used to estimate per-unit energy and demand savings for advanced power strips.

Table 72. Online Store Tier 1 Advanced Power Strip Savings Algorithms and Assumptions

Parameter	Assumption	Source and notes
Algorithms		
KWH savings	= 56.50 for 5-plug, 103.00 for 7-plug; deemed by IL TRM V8.0	
KWH savings	= 56.50 for 5-plug, 103.00 for 7-plug; deemed by ILTRM V8.0	
Parameters		
Hours	7,129	Deemed by IL TRM V8.0
CF	0.80	Deemed by IL TRM V8.0

Smart Sockets

Table 73 provides the formulas and parameters the team used to estimate per-unit energy and demand savings for smart sockets. The deemed per-unit savings values reflect a blended average based on review of program-tracking data, assuming 75% of installed smart sockets are used with energy-efficient CFL or LED lighting (savings of 0.96 KWH and 0.0004 KW) and 25% are used with non-energy-efficient halogen or incandescent lighting (savings of 11.05 KWH and 0.0012 KW).

Table 73. Online Store Smart Socket Savings Algorithms and Assumptions

Parameter	Assumption	Source and Notes
Algorithms		
KWH savings	= (WattsEE or NonEE / 1000) * Hours * SVG * ISR * (WHFeHeat + (WHFeCool – 1)) - StandbyKWH	
KW savings	= (WattsEE or NonEE / 1000) * SVG * ISR * WHFd * CF	
Parameters		
WattsEE	11	Average EE wattage (PY10 average standard LED is 10 W, increased to account for CFLs). Assumed 75% of cases.
WattsNonEE	43	Average non-EE wattage (halogen equivalent of 10 W standard LED). Assumed 25% of cases.
Hours	679	Annual hours of use (Mid-Atlantic TRM V9.0)
SGV	0.49	Percentage of lighting use saved by lighting control (Mid-Atlantic TRM V9.0)
WHFeHeat	1.0	Waste Heat Factor for Energy to account for electric heating savings from reducing waste heat (Mid-Atlantic TRM V9.0)
WHFeCool	1.0	Waste Heat Factor for Energy to account for cooling savings from reducing waste heat (Mid-Atlantic TRM V9.0)
StandbyKWH	2.63	Standby power draw of the controlled lamp (Mid-Atlantic TRM V9.0)
WHFd	1.17	Waste Heat Factor for Demand to account for cooling savings from reducing waste heat (Mid-Atlantic TRM V9.0)
CF	0.059	Coincidence factor (Mid-Atlantic TRM V9.0)

Faucet Aerators

Table 74 provides the formulas and parameters the team used to estimate per-unit energy and demand savings for faucet aerators.

Table 74. Online Store Faucet Aerators Savings Algorithms and Assumptions

Parameter	Bathroom	Kitchen	Unknown	Sources and Notes
Algorithms				
KWH savings	= (((Baseline GPM * Baseline Throttling Factor - Efficient GPM * Efficient Throttling Factor)*(Minutes/Person/Day))* (People/Household) * 365.25 * DF / (Faucets/Household))* (8.33 * (Tmix-Tinlet))/(RE * 3,412) * %Elec WH			
KW savings	= KWH Savings / Hours * CF			
Parameters				
Baseline GPM	1.60	2.20	2.20	IL TRM V8.0.
Efficient GPM (1.0 GPM)	1.00	1.00	1.00	Actual based on program-tracking data.
Efficient GPM (1.0 GPM)	1.50	1.50	1.50	Actual based on program-tracking data.
Baseline throttling factor	0.83	0.83	0.83	IL TRM V8.0
Efficient throttling factor	0.95	0.95	0.95	IL TRM V8.0
Minutes/person/day	1.60	4.50	2.36	IL TRM V8.0. Cadmus and Opinion Dynamics Showerhead and Faucet Aerator Meter Study Memorandum dated June 2013, metering at 135 single- and multi-family homes in Michigan.
People/household	2.45	2.45	2.45	Average people/household determined through participant surveys of similar programs within North Carolina and South Carolina jurisdictions.
Faucets/household	2.83	1.00	2.35	IL TRM V8. Based on findings from a 2009 ComEd residential survey of 140 sites, provided by Cadmus.
Mixed water temperature (Tmix °F)	86.00	93.00	87.83	IL TRM V8. Cadmus and Opinion Dynamics Showerhead and Faucet Aerator Meter Study Memorandum dated June 2013, directed to Michigan Evaluation Working Group.
Supply water temperature (Tinlet °F)	69.11	69.11	69.11	NREL Domestic Hot Water Event Generator calculator Columbia, SC.
Recovery efficiency (RE)	0.98	0.98	0.98	Recovery efficiency for standard electric resistance water heaters (consistent assumption across Illinois TRM V8.0, Indiana TRM V2.2, Arkansas TRM).
Hours	8.43	67.11	23.75	Calculated using the following formula: (Minutes/Person/Day) * (People/Household) / (Fixtures/Household) / 60 * 365.25
Coincidence factor (CF)	0.0012	0.0033	0.0017	IN TRM V2.2. Based on Wisconsin TRM which has a peak period that spans 12 hours like that of DESC (10 a.m.—10 p.m.)
Drain factor (DF)	90%	75%	86%	IL TRM V8.0. This represents the portion of the water that flows directly down the drain and is not collected for another purpose. If the water is collected, it will not save any energy, as the volume is constant regardless of the flow rate.
Electric water heating fuel weight (%Elec WH)	92%	92%	92%	Water heating fuel types are not tracked for Online Store participants and therefore rely on results from the 2019 DESC Potential Market Study for electric-only customers.

Low-Flow Showerheads

Table 75 provides the formulas and parameters the team used to estimate per-unit energy and demand savings for low-flow showerheads.

Table 75. Online Store Low-Flow Showerhead Savings Algorithms and Assumptions

Parameter	Assumption	Source and Notes
Algorithms		
KWH savings	= (Baseline GPMbase - Efficient GPM) * (Showers/Person/Day) * (Minutes/Person/Shower) * (People/Household) / (Showers Fixtures/Household) * 365.25 * (Tmix - Tinlet) * 8.33 / (3,412 * RE) * %Elec WH	
KW savings	= KWH Savings / Hours * CF	
Parameters		
Baseline GPM	2.35	Use actual GPM from program database if available; otherwise, rely on Time-of-Sale values for the Residential Lighting Program from the IL TRM V8.0.
Efficient GPM	1.50	Use actual, if available.
Showers/person/day	0.60	IL TRM V8.0
Minutes/person/shower	7.80	IL TRM V8.0
People/household	2.45	Average people/household determined through participant surveys of similar programs within North Carolina and South Carolina jurisdictions.
Shower fixtures/household	1.64	Home types are unknown for Residential Lighting participants and therefore rely on the default value for “unknown” home type from the IL TRM V8.0.
Mixed water temperature (Tmix °F)	101.00	IL TRM V8.0.
Supply water temperature (Tinlet °F)	69.11	NREL Domestic Hot Water Event Generator calculator Columbia, SC.
Recovery efficiency (RE)	0.98	Recovery efficiency for standard electric resistance water heaters (consistent assumption across Illinois TRM V8.0, Indiana TRM V2.2, Arkansas TRM).
Hours	42.56	Calculated using the following formula: (Showers/Person/Day) * (Minutes/Person/Shower) * (People/Household) / (Shower Fixtures/Household) / 60 * 365.25
CF	0.002	IN TRM V2.2. Based on Wisconsin TRM, which has a peak period that spans 12 hours like that of DESC (10 a.m. - 10 p.m.)
Electric water heating fuel weight (%Elec WH)	92%	Water heating fuel types are unknown for Residential Lighting participants and therefore rely on results from the 2019 DESC Potential Market Study.

Shower Thermostatic Valves

Table 76 provides the formulas and parameters the team used to estimate per-unit energy and demand savings for shower thermostatic valves.

Table 76. Online Store Shower Thermostatic Valve Savings Algorithms and Assumptions

Parameter	Assumption	Source and Notes
Algorithms		
KWH savings	= (GPM * HWWT * (People/Household) * (Showers/Person/Day) * 365.25 / (Showers Fixtures/Household) * (8.33 * (Tmix - Tinlet) / (RE * 3,412) * %Elec WH	
KW savings	= KWH Savings / Hours * CF	
Parameters		
GPM (w/o low-flow showerhead)	2.35	Use actual GPM from program database if available; otherwise, rely on Time-of-Sale values for the Residential Lighting Program from the IL TRM V8.0.
GPM (w/ low-flow showerhead) a	1.50	Actual flow rate of low-flow showerheads offered for the Residential Lighting Program.
Hot water waste time (HWWT)	0.89	IL TRM V8.0.
People/household	2.45	Average people/household determined through participant surveys of similar programs within North Carolina and South Carolina jurisdictions.
Shower Fixtures/Household (unknown home type)	1.64	Home types are unknown for Residential Lighting participants and therefore rely on the default value for "unknown" home type from the IL TRM V8.0.
Showers/person/day	0.60	IL TRM V8.0
Mixed water temperature (Tmix °F)	101.00	IL TRM V8.0.
Supply water temperature (Tinlet °F)	69.11	NREL Domestic Hot Water Event Generator calculator Columbia, SC.
Recovery efficiency (RE)	0.98	Recovery efficiency for standard electric resistance water heaters (consistent assumption across Illinois TRM, Indiana TRM, Arkansas TRM).
Electric water heating fuel weight (%Elec WH)	92%	Water heating fuel types are unknown for Residential Lighting participants and therefore rely on results from the 2019 DESC Potential Market Study.
Hours (w/o low-flow showerhead)	17.03	Calculated using the formula from Mid-Atlantic TRM V9.0
Hours (w/ low-flow showerhead)	10.87	Calculated using the formula from Mid-Atlantic TRM V9.0
Coincidence factor (CF)	0.002	IN TRM V2.2. Based on Wisconsin TRM, which has a peak period that spans 12 hours like that of DESC (10 a.m. - 10 p.m.)

a. A 2.35 GPM assumption is appropriate when the TSV is installed in combination with a low-flow showerhead.

Ex-Ante and Revised Gross Per-Unit Deemed Savings Comparison

Table 77 provides a list of 80 products for which the Evaluation Team made substantive (i.e., non-rounding) deemed per-unit savings revisions compared to ex-ante. About two-thirds of these products (59 of 80; 74%) were new products in PY10 and, as such, the team evaluated them for the first time.

Table 77. EnergyWise Savings Store Per-Unit Deemed Savings Comparison

Product ID	Product Description	Ex-Ante Per-Unit		Revised Gross Per-Unit	
		KWH	KW	KWH	KW
Existing Products: Corrected Deemed Savings Values					
R2010.304	Standard LED (11W)	36.14	0.0030	35.04	0.0032
R1160.9865	Reflector LED (BR20, 7W)	36.14	0.0030	47.09	0.0043
R2040.457	Reflector LED (BR30, 7W)	60.77	0.0060	63.51	0.0058
R2040.101	Reflector LED (BR30, 9W)	60.23	0.0060	61.32	0.0056
R2040.1021	Reflector LED (R20, 7W)	36.14	0.0030	47.09	0.0043
R2300.601	Reflector LED (PAR38, 15W)	52.56	0.0050	54.75	0.0050
R2060.305	Decorative LED (6.5W)	38.33	0.0040	36.68	0.0034
R2060.841	Decorative LED (8W)	37.23	0.0030	56.94	0.0052
R2070.205	Smart LED (A-Line, 9W)	36.14	0.0030	37.23	0.0034
R2070.209	Smart LED (BR30, 8W)	60.77	0.0060	56.94	0.0052
R7005.616	Advanced Power Strip - Tier 1 (4-outlet)	102.80	0.0120	56.50	0.0063
R7005.609	Advanced Power Strip - Tier 1 (7-outlet)	102.80	0.0120	103.00	0.0116
R7005.605	Advanced Power Strip - Tier 1 (12-outlet)	102.80	0.0120	103.00	0.0116
R3000.5324	Showerhead (1.5 GPM with TSV)	279.00	0.0300	190.59	0.0154
R3000.5325	Showerhead (1.5 GPM with TSV)	279.00	0.0300	190.59	0.0154
R3000.172	Showerhead (1.5 GPM)	279.00	0.0300	158.65	0.0086
R3000.943	Showerhead (1.5 GPM)	279.00	0.0300	158.65	0.0086
R3010.03	Faucet Aerator (1.0GPM)	225.00	0.0100	29.01	0.0021
SAVERKIT.DL	Energy Saver Kit (Decorative)	666.75	0.0620	669.65	0.0620
SAVERKIT.OL	Energy Saver Kit (Outdoor)	628.53	0.0540	647.69	0.0540
SAVERKIT.RL	Energy Saver Kit (Recessed)	776.25	0.0720	781.90	0.0720
New Products: Evaluated Per-Unit Deemed Savings for the First Time					
F7A19DLED27-3	Standard LED (7W)	56.94	0.0052	24.09	0.0022
F7A19DLED27-4	Standard LED (7W)	56.94	0.0052	24.09	0.0022
F7A19DLED27-5	Standard LED (7W)	56.94	0.0052	24.09	0.0022
L9W-A19-CCT-RGB-WiFi	Standard LED (9W)	36.14	0.0033	37.23	0.0034
L11A1927KENCL-3	Standard LED (11W)	42.71	0.0039	45.99	0.0042
L11A1927KENCL-4	Standard LED (11W)	42.71	0.0039	45.99	0.0042
L11A1927KENCL-5	Standard LED (11W)	42.71	0.0039	45.99	0.0042
L15A1927KENCL-2	Standard LED (15W)	59.13	0.0054	62.42	0.0057
L15A1927KENCL-4	Standard LED (15W)	59.13	0.0054	62.42	0.0057
R2010.103	Standard LED (15W)	59.13	0.0050	62.42	0.0057

Product ID	Product Description	Ex-Ante Per-Unit		Revised Gross Per-Unit	
		KWH	KW	KWH	KW
L8W-BR30-CCT-RGB-WiFi	Reflector LED (BR30, 8W)	56.94	0.0052	62.42	0.0057
LR30D11W-27K-3	Reflector LED (BR30, 11W)	58.04	0.0053	59.13	0.0054
LR30D11W-27K-4	Reflector LED (BR30, 11W)	58.04	0.0053	59.13	0.0054
LR30D11W-27K-5	Reflector LED (BR30, 11W)	58.04	0.0053	59.13	0.0054
R2040.556	Reflector LED (PAR38, 11W)	52.56	0.0050	59.13	0.0054
R2040.829	Reflector LED (PAR38, 15W)	52.56	0.0050	54.75	0.0050
LPAR30DW11W-27K-2	Reflector LED (PAR30, 11W)	59.68	0.0055	42.71	0.0039
LPAR30DW11W-27K-4	Reflector LED (PAR30, 11W)	59.68	0.0055	42.71	0.0039
L12A193WAY27K-2	3-way LED (12W)	42.71	0.0039	68.99	0.0063
L12A193WAY27K-4	3-way LED (12W)	42.71	0.0039	68.99	0.0063
R2030.2011	Decorative LED (3.3W)	39.42	0.0040	40.19	0.0037
FF4B11D927E26-3	Decorative LED (4W)	26.28	0.0024	39.42	0.0036
FF4B11D927E26-4	Decorative LED (4W)	26.28	0.0024	39.42	0.0036
FF4B11D927E26-5	Decorative LED (4W)	26.28	0.0024	39.42	0.0036
L05CDL2700K-3	Decorative LED (5W)	38.33	0.0035	60.23	0.0055
L05CDL2700K-4	Decorative LED (5W)	38.33	0.0035	60.23	0.0055
L05CDL2700K-5	Decorative LED (5W)	38.33	0.0035	60.23	0.0055
R2030.101_6	Decorative LED (5W)	38.33	0.0040	60.23	0.0055
EF4.5G25D27-3	Globe LED (4.5W)	57.49	0.0053	60.77	0.0056
EF4.5G25D27-4	Globe LED (4.5W)	57.49	0.0053	60.77	0.0056
EF4.5G25D27-5	Globe LED (4.5W)	57.49	0.0053	60.77	0.0056
6G25DLED27-3	Globe LED (6W)	57.49	0.0053	37.23	0.0034
6G25DLED27-4	Globe LED (6W)	57.49	0.0053	37.23	0.0034
6G25DLED27-5	Globe LED (6W)	57.49	0.0053	37.23	0.0034
L06G252700K-3	Globe LED (6W)	38.33	0.0035	37.23	0.0034
L06G252700K-4	Globe LED (6W)	38.33	0.0035	37.23	0.0034
L06G252700K-5	Globe LED (6W)	38.33	0.0035	37.23	0.0034
R2010.558	Globe LED (10W)	172.47	0.0150	54.75	0.0050
R1000.798	Linear LED (12W)	24.09	0.0020	21.90	0.0020
L14T8G40AB-10PK	Linear LED (14W)	60.23	0.0055	19.71	0.0018
L12T8G40A-4	Linear LED (21W)	24.09	0.0022	12.05	0.0011
N2515CH	Showerhead (1.5 GPM)	147.78	0.0086	158.65	0.0086
N2915CH	Showerhead (1.5 GPM)	147.78	0.0086	158.65	0.0086
N2945CH	Showerhead (1.5 GPM)	147.78	0.0086	158.65	0.0086
N3915BN	Showerhead (1.5 GPM)	147.78	0.0086	158.65	0.0086
N9415CH	Showerhead (1.5 GPM)	147.78	0.0086	158.65	0.0086
N9415CH-HH	Showerhead (1.5 GPM)	147.78	0.0086	158.65	0.0086
N3104-PC	Faucet Aerator (1.5GPM)	29.01	0.0021	7.07	0.0010
N3115P	Faucet Aerator (1.5GPM)	13.28	0.0010	66.31	0.0033

Product ID	Product Description	Ex-Ante Per-Unit		Revised Gross Per-Unit	
		KWH	KW	KWH	KW
IK.NEST1	Advanced Thermostat	610.00	0.2025	458.51	0.1800
IK.NEST2	Advanced Thermostat	610.00	0.2025	458.51	0.1800
R5000.34	Advanced Thermostat	610.00	0.2025	458.51	0.1800
R5000.96	Advanced Thermostat	610.00	0.2025	458.51	0.1800
R5000.999	Advanced Thermostat	610.00	0.2025	458.51	0.1800
R5000.9992	Advanced Thermostat	610.00	0.2025	458.51	0.1800
SS-15A1-WiFi	Smart Socket	0.00	0.0000	3.48	0.0006
SCSmartHome-1	Smart Bundle	93.08	0.0085	90.18	0.0088
L11A1927KENCL	Standard LED (Free LED Kit, 11W)	42.71	0.0039	45.99	0.0042
L15A1927KENCL	Standard LED (Free LED Kit, 15W)	59.13	0.0054	62.42	0.0057

Ex-Ante and Revised Gross Savings Summary

Table 78 summarizes ex-ante gross savings, revised gross savings, and the gross savings realization rates before applying ISRs for all product types. Differences shown here between ex-ante and revised gross savings reflect updates to per-unit deemed savings values outlined in Table 77 as well as rounding differences, a small number of quantity corrections, and cases where per-pack or per-kit savings were applied as per-bulb savings, primarily for returns and Free LED Kits.

Table 78. EnergyWise Savings Store Gross Savings by Channel and Product Type

Program Channel	Product Type	Verified Units Sold	Ex-Ante Total		Revised Gross Total		Pre-ISR Gross Realization Rate	
			KWH	KW	KWH	KW	KWH	KW
Online Store	Standard LED (6 W)	2,271	57,383	4.71	57,206	5.22	1.00	1.11
Online Store	Standard LED (7 W)	923	52,669	4.81	22,235	2.03	0.42	0.42
Online Store	Standard LED (9 W)	16,763	623,345	54.02	624,086	56.99	1.00	1.06
Online Store	Standard LED (9.5 W)	74	2,714	0.22	2,714	0.25	1.00	1.13
Online Store	Standard LED (11 W)	3,277	137,648	12.46	146,855	13.41	1.07	1.08
Online Store	Standard LED (15 W)	3,282	194,065	17.63	204,862	18.71	1.06	1.06
Online Store	Standard LED (18 W)	71	4,198	0.36	4,198	0.38	1.00	1.08
Online Store	Reflector LED (BR20, 7 W)	33	1,193	0.10	1,554	0.14	1.30	1.43
Online Store	Reflector LED (BR30, 7 W)	60	3,646	0.36	3,811	0.35	1.05	0.97
Online Store	Reflector LED (BR30, 8 W)	128	7,288	0.67	7,990	0.73	1.10	1.10
Online Store	Reflector LED (BR30, 9 W)	867	52,219	5.20	53,164	4.86	1.02	0.93
Online Store	Reflector LED (BR30, 10 W)	2,608	157,080	14.70	157,080	14.34	1.00	0.98
Online Store	Reflector LED (BR30, 11 W)	2,333	135,407	12.36	137,950	12.60	1.02	1.02
Online Store	Reflector LED (BR30, 12 W)	1,193	69,242	5.96	69,242	6.32	1.00	1.06
Online Store	Reflector LED (BR40, 9 W)	196	12,019	1.18	12,019	1.10	1.00	0.93
Online Store	Reflector LED (R20, 7 W)	135	4,879	0.41	6,357	0.58	1.30	1.43
Online Store	Reflector LED (PAR38, 11 W)	1,564	82,204	7.82	92,479	8.45	1.13	1.08
Online Store	Reflector LED (PAR38, 15 W)	1,279	69,804	6.39	70,025	6.39	1.00	1.00
Online Store	Reflector LED (PAR30, 11 W)	610	36,405	3.36	26,053	2.38	0.72	0.71

Program Channel	Product Type	Verified Units Sold	Ex-Ante Total		Revised Gross Total		Pre-ISR Gross Realization Rate	
			KWH	KW	KWH	KW	KWH	KW
Online Store	3-way LED (12 W)	2,134	91,143	8.32	147,225	13.44	1.62	1.62
Online Store	3-way LED (18 W)	100	4,599	0.40	4,599	0.42	1.00	1.05
Online Store	Decorative LED (3.3 W)	143	5,637	0.57	5,747	0.53	1.02	0.93
Online Store	Decorative LED (4 W)	2,270	78,656	7.24	89,483	8.17	1.14	1.13
Online Store	Decorative LED (5 W)	6,248	225,930	21.39	288,980	26.39	1.28	1.23
Online Store	Decorative LED (6.5 W)	2	77	0.01	73	0.01	0.96	0.85
Online Store	Decorative LED (8 W)	192	7,148	0.58	10,932	1.00	1.53	1.73
Online Store	Globe LED (4.5 W)	667	38,346	3.54	40,534	3.74	1.06	1.06
Online Store	Globe LED (5 W)	936	35,877	3.74	35,877	3.28	1.00	0.87
Online Store	Globe LED (6 W)	992	42,334	3.88	36,932	3.37	0.87	0.87
Online Store	Globe LED (7.5 W)	1	57	0.01	57	0.01	1.00	1.06
Online Store	Globe LED (10 W)	330	63,124	5.49	18,068	1.65	0.29	0.30
Online Store	Linear LED (7 W)	39	1,068	0.12	1,068	0.10	1.00	0.83
Online Store	Linear LED (12 W)	130	3,132	0.26	2,847	0.26	0.91	1.00
Online Store	Linear LED (14 W)	1	60	0.01	20	0.00	0.33	0.33
Online Store	Linear LED (21 W)	944	23,175	2.12	11,375	1.04	0.49	0.49
Online Store	Downlight LED Fixture (10 W)	14	767	0.07	767	0.07	1.00	1.00
Online Store	Downlight LED Fixture (11 W)	38	3,079	0.27	3,079	0.28	1.00	1.06
Online Store	Downlight LED Fixture (14 W)	127	6,397	0.64	6,397	0.58	1.00	0.92
Online Store	Smart LED (A-Line, 9 W)	3	108	0.01	112	0.01	1.03	1.13
Online Store	Smart LED (A-Line, 10 W)	1	36	0.00	36	0.00	1.00	1.10
Online Store	Smart LED (BR30, 8 W)	2	122	0.01	114	0.01	0.94	0.87
Online Store	Advanced Power Strip - Tier 1 (4-outlet)	23	2,364	0.28	1,300	0.14	0.55	0.53
Online Store	Advanced Power Strip - Tier 1 (7-outlet)	1,450	149,313	16.89	149,350	16.82	1.00	1.00
Online Store	Advanced Power Strip - Tier 1 (12-outlet)	1,120	115,343	13.03	115,360	12.99	1.00	1.00
Online Store	Showerhead (1.5 GPM with TSV)	6	1,674	0.18	1,144	0.09	0.68	0.51

Program Channel	Product Type	Verified Units Sold	Ex-Ante Total		Revised Gross Total		Pre-ISR Gross Realization Rate	
			KWH	KW	KWH	KW	KWH	KW
Online Store	Showerhead (1.5 GPM)	634	93,955	5.50	100,584	5.45	1.07	0.99
Online Store	Faucet Aerator (1.0GPM)	4	900	0.04	116	0.01	0.13	0.21
Online Store	Faucet Aerator (1.5GPM)	264	5,425	0.40	10,279	0.59	1.89	1.48
Online Store	Energy Saver Kit (Decorative)	20,144	842,190	78.06	843,089	78.06	1.00	1.00
Online Store	Energy Saver Kit (Outdoor)	5,910	252,239	21.28	255,190	21.28	1.01	1.00
Online Store	Energy Saver Kit (Recessed)	10,976	534,818	49.39	536,383	49.39	1.00	1.00
Online Store	Advanced Thermostat	3,781	1,745,897	682.40	1,733,626	681.15	0.99	1.00
Online Store	Smart Socket	1,007	-	-	3,504	0.60	N/A	N/A
Online Store	Smart Bundle	17	1,582	0.14	1,533	0.15	0.97	1.04
Free LED	Standard LED (9 W)	7,500	1,396,125	127.50	279,225	25.50	0.20	0.20
Free LED	Standard LED (11 W)	2,500	533,875	48.75	114,975	10.50	0.22	0.22
Free LED	Standard LED (15 W)	2,500	739,125	67.50	156,050	14.25	0.21	0.21
Total	N/A	110,817	8,749,107	1,322.71	6,705,912	1,136.57	0.77	0.86

In-Service Rates and Carryover Savings

The Evaluation Team estimated ISRs using PY10 participant survey results. In the survey, the team asked customers if they recalled receiving the measures and if they had removed any of the measures. The team developed ISRs using this data, which reflect the number of measures still installed. The team calculated the ISRs as follows:

$$\text{In-Service Rate} = \frac{\text{Number of measures verified by survey respondents as still installed}}{\text{Number of measures tracked in the program database as installed}}$$

The Evaluation Team applied the ISR estimates outlined in Table 79. The survey included all measure categories except for smart sockets. For smart sockets, the team used the ISR recommended by the Mid-Atlantic TRM (Version 9).

Table 79. EnergyWise Savings Store First-Year ISR Values Applied for PY10

Measure	ISR	Source
Standard LEDs	75%	PY10 participant survey (n=191)
Reflector LEDs	64%	PY10 participant survey (n=123)
Specialty LEDs	68%	PY10 participant survey (n=141)
Advanced power strips	69%	PY10 participant survey (n=151)
Advanced thermostats	81%	PY10 participant survey (n=169)
Water-saving measures	65%	PY10 participant survey (n=53)
Smart sockets	98%	Mid-Atlantic TRM V9.0

The Evaluation Team estimated PY10-claimable carryover savings by multiplying verified gross and net savings from PY7, PY8, and PY9 lighting products by their associated PY10 carryover rates. The team determined carryover rates using the 2017 UMP methods.¹⁵ Table 80 below provides a detailed installation trajectory for all bulbs distributed in PY7, PY8, or PY9 from the year they were distributed through PY10.

Table 80. EnergyWise Savings Store Lighting Installation Trajectories for Savings Claimed in PY10

Program Year and Component	Installation Trajectories by Year			
	PY7	PY8	PY9	PY10
PY7 Online Store	64%	36% x 24% = 9%	27% x 24% = 6%	21% x 24% = 5%
PY7 Business Office Lighting (BOL)	67%	33% x 24% = 8%	25% x 24% = 6%	19% x 24% = 6%
PY7 Low-Income Free LED Kits	61%	39% x 24% = 9%	30% x 24% = 7%	23% x 24% = 5%
PY8 Online Store (Lighting)	N/A	64%	36% x 24% = 9%	27% x 24% = 6%
PY8 BOL	N/A	67%	33% x 24% = 8%	25% x 24% = 6%
PY8 Low-Income Free LED Kits	N/A	61%	39% x 24% = 9%	30% x 24% = 7%
PY9 Online Store (Lighting)	N/A	N/A	64%	36% x 24% = 9%
PY9 BOL	N/A	N/A	67%	33% x 24% = 8%
PY9 Low-Income Free LED Kits	N/A	N/A	61%	39% x 24% = 9%

¹⁵ Li, M.; Haeri, H.; Reynolds, A, "Chapter 6: Residential Lighting Evaluation Protocol. Section 4.10 In-Service Rate," in *The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures*. (Golden, CO; National Renewable Energy Laboratory, 2018) NREL/SR-7A40-70472.

In PY11 through PY13, savings from bulbs DESC distributed in PY8, PY9, and PY10 will be claimable as carryover. Table 81 below provides the detailed trajectory for future installations of bulbs distributed from PY8 through PY10.

Table 81. EnergyWise Savings Store Lighting Installation Trajectories for Savings Claimed in Future Years

Program Component	Installation Trajectories by Year			
	PY10	PY11	PY12	PY13
PY8 Online Store (Lighting)	27% x 24% = 6%	21% x 24% = 5%	N/A	N/A
PY8 BOL	25% x 24% = 6%	19% x 24% = 6%	N/A	N/A
PY8 Low-Income Free LED Kits	30% x 24% = 7%	23% x 24% = 5%	N/A	N/A
PY9 Online Store (Lighting)	36% x 24% = 9%	27% x 24% = 6%	21% x 24% = 5%	N/A
PY9 BOL	33% x 24% = 8%	25% x 24% = 6%	19% x 24% = 6%	N/A
PY9 Low-Income Free LED Kits	39% x 24% = 9%	30% x 24% = 7%	23% x 24% = 5%	N/A
PY10 Online Store (Standard LEDs)	75%	25% x 24% = 6%	19% x 24% = 5%	14% x 24% = 3%
PY10 Online Store (Reflector LEDs)	64%	36% x 24% = 9%	27% x 24% = 6%	21% x 24% = 5%
PY10 Online Store (Specialty LEDs)	68%	32% x 24% = 8%	24% x 24% = 6%	18% x 24% = 8%
PY10 Low-Income Free LED Kits	61%	39% x 24% = 9%	30% x 24% = 7%	23% x 24% = 4%

Note: Some Energy Saver kits sold through the Online Store include non-lighting products. In these cases, the lighting ISR and carryover trajectory only applies to the included lighting measures.

Net-to-Gross Methods and Results

This section details the sources and methods the Evaluation Team used to calculate NTGRs for new non-lighting measures. The NTGR represents the portion of the energy and demand savings associated with a program that would not have been realized in the absence of the program. In other words, the NTGR ratio represents the share of program-induced savings. The NTGR ratio consists of FR and participant spillover. FR is the proportion of the program-achieved verified gross savings that would have been realized absent the program. Spillover occurs when participants take additional energy-saving actions that are influenced by program interventions but did not receive program support.

To estimate ex-post net savings for LED lighting measures, the Evaluation Team relied on FR and spillover estimated as part of the PY6 and PY7 Online Store and Free LED Kit evaluations, respectively. To estimate FR and spillover for Online Store non-lighting measures, the Evaluation Team conducted a web survey with PY10 participants. For smart sockets, which were introduced towards the end of PY10 and account for less than 1% of savings, the team applied a placeholder value of 1.00 in the absence of directly applicable primary research.

The final NTGR for each program was calculated using the equation provided below.

Equation 3. NTGR Formula

$$NTGR = (1 - FR) + Spillover$$

Table 82 provides a summary of FR, spillover, and final NTGRs for each measure and program channel.

Table 82. EnergyWise Saving Store NTGR Estimates Applied for PY10

Measure	FR	Spillover	NTGR	Source
LED Lighting (Online Store)	0.29	0.02	0.73	PY6 participant survey
LED Lighting (Free LED Kits)	0.08	0.03	0.95	PY7 participant survey
Advanced power strips	0.08	<0.01	0.92	PY10 participant survey (n=101)
Advanced thermostats	0.19		0.81	PY10 participant survey (n=127)
Water saving measures	0.03		0.97	PY10 participant survey (n=40)
Smart sockets	N/A	N/A	1.00	Mid-Atlantic TRM V9.0

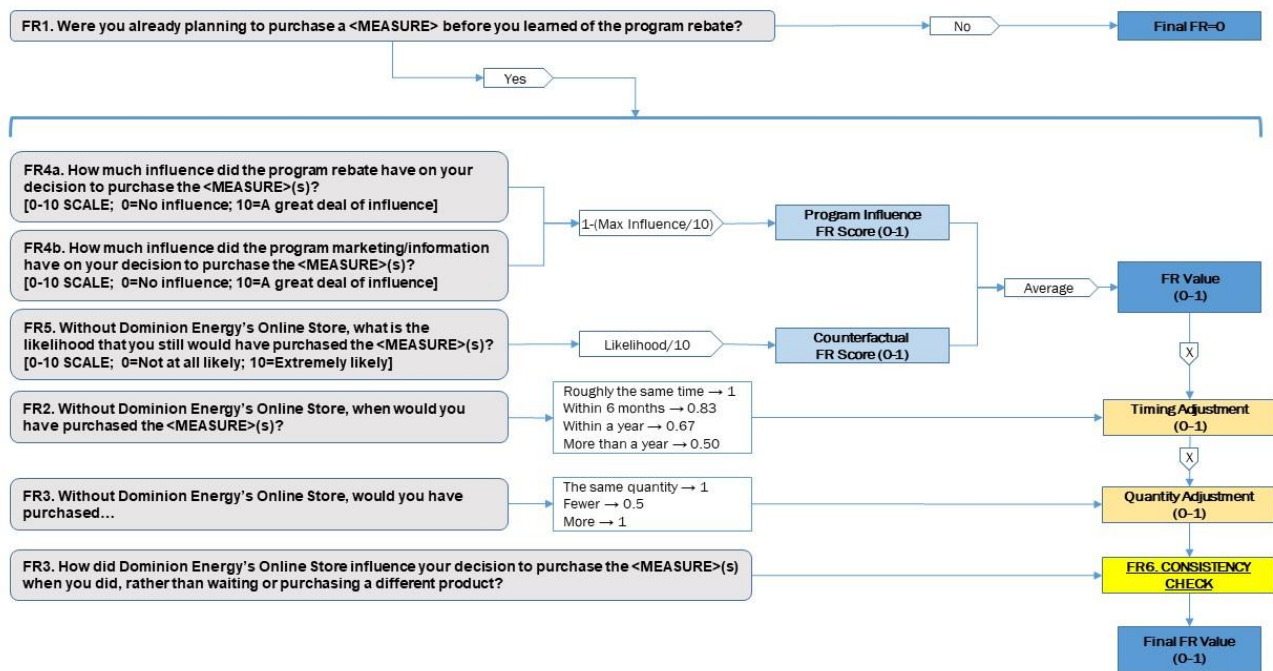
Online Store Non-Lighting Free Ridership Methodology

The Evaluation Team relied on PY10 participant survey responses to develop estimates of FR. To assess FR, the survey first asked participants about their intentions prior to learning of available Online Store discounts. Those participants who reported they had no plans to purchase a comparable energy-efficient product prior to learning of the program rebate were deemed non-free riders (FR=0).

For respondents that had been considering comparable products prior to learning of the rebate, the survey asked them to rate the influence of the program rebate and of program-provided information on their purchase decision using a 0-10 scale where 0 is “no influence” and 10 is “a great deal of influence.” The team used the maximum of their two influence ratings to calculate a “Program Influence FR Score.” The survey also asked them to rate the hypothetical likelihood that they would have purchased a comparable product without the program using a 0-10 scale where 0 is “not at all likely” and 10 is “extremely likely.” The team used their likelihood rating to calculate a “Counterfactual FR Score.” The average of each respondent’s Program Influence and Counterfactual FR Scores was their “Preliminary FR Value.” These program influence and counterfactual FR scores range from 0 to 1 where 0 represents a non-free rider and 1 represents a complete free rider.

The Evaluation Team also explored the degree to which the program affected the timing and quantity of energy-efficient product purchases. In cases where customers reported that they would have purchased a comparable product later or would have purchased fewer units of an energy-efficient product, the team adjusted FR accordingly. To validate responses, the Evaluation Team also compared respondents’ influence and counterfactual ratings with their open-ended responses to a question asking them to describe how the program influenced their purchase decision and omitted or adjusted inconsistent responses. Figure 1 below presents the detailed algorithm.

Figure 1. Online Store Non-Lighting Free Ridership Algorithm



Online Store Non-Lighting Spillover Methodology

The Evaluation Team also relied on PY10 participant survey responses to develop estimates of spillover for Online Store non-lighting participants. The survey asked respondents about any non-rebated purchases of energy-efficient products made since participating in the Online Store program and about the degree to which the program influenced those purchase decisions. Respondents who reported purchasing additional energy-efficient products were asked follow-up questions about the degree to which they felt the program influenced their purchase, both in the form of quantitative ratings (both influence and counterfactual ratings, much like FR method) and a qualitative explanation. For participants who gave high ratings of program influence and low ratings of likelihood to purchase in the program's absence (at least 7/10 on average between influence rating and inverse of likelihood rating) and provided valid explanation of their ratings, spillover savings were calculated based on their reported purchases.

From the 704 surveyed participants, five respondents reported subsequent purchases qualifying for spillover. Respondents with qualifying spillover purchases each reported between one and four energy-efficient purchases. The team estimated per-unit savings for each of these measures based on the South Carolina Measure Database (SCMDB), recommended deemed per-unit savings for existing DESC programs, and review of relevant TRMs. Table 83 summarizes the per-measure savings for each identified spillover measure.

Table 83. EnergyWise Saving Store Per-Unit Savings Estimates for Spillover Measures

Measure	KWH	KW	Source
Attic insulation	60.96	0.0332	SCMDB
Weather stripping	147.71	0.0599	PY11 NEEP Planning Memo
Clothes washer (gas water heating)	145.15	0.0158	Mid-Atlantic TRM V9.0
Faucet aerator (electric water heating)	21.14	0.0016	PY10 Online Store evaluation
Low-flow showerhead (electric water heating)	158.65	0.0086	PY10 Online Store evaluation
Refrigerator or freezer	360.15	0.0580	PY11 NEEP Planning Memo
Air purifier	158.75	0.0183	IL TRM V9.0 (Average for all CADR ranges)
Dishwasher (gas water heating)	46.00	0.0200	SCMDB

The Evaluation Team estimated a spillover rate using the following equation, amounting to 0.4%. This estimate was used in concert with measure-specific FR results to estimate NTGR for each non-lighting measure sold through the Online Store in PY10.

Equation 4. Spillover Formula

$$Spillover = \frac{\text{Survey Respondent Spillover Savings}}{\text{Gross Program Savings from All Survey Respondents}} = 0.4\%$$

Appendix C. Heating & Cooling Detailed Methods

Heating & Cooling Equipment Deemed Savings

PY10 Heating & Cooling Equipment Engineering Algorithms and Assumptions

The Evaluation Team applied the following equations to derive the PY10 energy and demand savings for Heating & Cooling Equipment measures:

Equation 5. Energy and Demand Savings Algorithms for CACs

$$kWh\ Savings = \left(FLH_{cool} * kBTUh * \left(\frac{1}{SEER_{baseline}} - \frac{1}{SEER_{EE}} \right) \right) * AF_{KWH,CAC}$$

$$kW\ Savings = \left(kBTUh * \left(\frac{1}{EER_{baseline}} - \frac{1}{EER_{EE}} \right) * CF \right) * AF_{KW,CAC}$$

Equation 6. Energy and Demand Savings Algorithms for ASHPs and DFHPs

$$kWh\ Savings = kWh\ Cooling\ Savings + kWh\ Heating\ Savings$$

$$kWh\ Cooling\ Savings = \left(FLH_{cool} * kBTUh * \left(\frac{1}{SEER_{baseline}} - \frac{1}{SEER_{EE}} \right) \right) * AF_{KWH,HP}$$

$$kWh\ Heating\ Savings = \left(FLH_{heat} * kBTUh * \left(\frac{1}{HSPF_{baseline}} - \frac{1}{HSPF_{EE}} \right) \right) * AF_{KWH,HP}$$

$$kW\ Savings = \left(kBTUh * \left(\frac{1}{EER_{baseline}} - \frac{1}{EER_{EE}} \right) * CF \right) * AF_{KW,HP}$$

Equation 7. Energy and Demand Savings Algorithms for GSHPs

$$kWh\ Savings = kWh\ Cooling\ Savings + kWh\ Heating\ Savings$$

$$kWh\ Cooling\ Savings = \left(FLH_{cool} * kBTUh * \left(\frac{1}{SEER_{baseline}} - \frac{1}{EER_{EE} * 1.02} \right) \right) * AF_{KWH,GSHP}$$

$$kWh\ Heating\ Savings = \left(FLH_{heat} * kBTUh * \left(\frac{1}{HSPF_{baseline}} - \frac{1}{COP_{EE} * 3.412} \right) \right) * AF_{KWH,GSHP}$$

$$kW\ Savings = \left(kBTUh * \left(\frac{1}{EER_{baseline}} - \frac{1}{EER_{EE}} \right) * CF \right) * AF_{KW,GSHP}$$

Where:

Full Load Cooling Hours (FLH_{cool}) = Estimated full load run-time hours to satisfy the cooling requirements for residents in South Carolina (average of Columbia and Charleston, SC)

Full Load Heating Hours (FLHheat) = Estimated full load run-time hours to satisfy the heating requirements for residents in South Carolina (average of Columbia and Charleston, SC)

Table 84. Full Load Hours

Location	FLHcool	FLHheat
Columbia	1,626	1,539
Charleston	2,127	1,212
Average	1,877	1,376

Source: U.S. EPA 2002.

Capacity (kBTUh) = Size of the installed HVAC system in units of kBTU per hour (kBTUh = tons * 12)

SEERbaseline = Baseline efficiency rating (in SEER) for cooling; actual existing efficiency from the tracking database is used for ER projects (if unknown assumed 10 SEER); a baseline rating of SEER 13 is used for all ROB projects

SEEREE = Efficiency rating (in SEER) for cooling of newly installed HVAC equipment from the program tracking database

EERbaseline = Baseline efficiency rating (in EER) for cooling ($EERbaseline = -0.02 * SEERbaseline^2 + 1.12 * SEERbaseline$)

EEREE = Efficiency rating (in EER) for cooling of newly installed HVAC equipment ($EEREE = -0.02 * SEEREE^2 + 1.12 * SEEREE$)

HSPFbaseline = Baseline efficiency rating (in HSPF) for heating; a baseline rating of 8.2 HSPF is used for ROB projects and 6.8 HSPF for ER projects

HSPFEE = Efficiency rating (in HSPF) for heating of newly installed air source or dual fuel heat pump from the program-tracking database

COPEE = Efficiency rating (in COP) for heating of newly installed GSHP from the program-tracking database

AF = Factor that calibrates algorithmic savings estimates to align with PY3 billing analysis results; Adjustment factors were derived as part of the PY5 evaluation. Refer to the PY5 Evaluation Report for the detailed methodology.

Table 85. Adjustment Factors

Measure	KWH	KW
CAC	0.38	1.00
ASHP and DFHP (SEEREE <16)	0.83	4.39
ASHP and DFHP (SEEREE ≥16)		3.14
GSHP	0.27	1.35

Coincidence Factor (CF) = A number between 0 and 1 indicating the number of cooling systems that are in use and saving energy during the peak summer demand period; average HVAC CF across 12 TRMs is 0.75

Dual-Fuel Heat Pump Savings

DFHPs operate differently than ASHPs in that they use backup gas heating when the outside air temperature is below equipment specifications. The thermostat for a DFHP monitors outside air temperature and decides whether to enable or disable heating from the DFHP. The temperature where this switch occurs is referred to as the balance point. There are three types of balance point designs, including:

- **Capacity Balance Point:** The temperature at which the heat pump can no longer provide sufficient capacity to satisfy the indoor heating demand. At this point, the supplemental gas furnace is required.
- **Economic Balance Point:** The temperature at which the heat pump is no longer cost-effective to operate. Typically set by the installer based on a cost-effectiveness analysis (outside the scope of this evaluation).
- **Comfort Balance Point:** The temperature at which the heat pump no longer provides hot enough air to make the home comfortable.

For the evaluation, the Evaluation Team focused on the comfort and capacity balance points. The Evaluation Team found that the coldest recorded temperatures in DESC's territory are outside the capacity and comfort balance point thresholds, thus requiring the backup gas furnace to operate on occasion. Therefore, the operation of DFHPs is not much different from ASHPs within South Carolina and, as a result, the Evaluation Team chose to evaluate DFHP savings identical to ASHP savings.

PY10 Heating & Cooling Equipment Deemed Savings

The Evaluation Team applied the pre-determined deemed per-ton savings values from previous program years for measures that existed prior to PY10 but were incented in PY10. The Evaluation Team developed per-ton deemed savings values for new measures in PY10 using the same methodology as detailed above. Table 86 summarizes the ex-ante and ex-post deemed savings values for each PY10 Heating & Cooling Equipment measure.

Table 86. Heating & Cooling Equipment Ex-Ante and Ex-Post Deemed Per-Ton Savings

Measure	Ex-Ante		Ex-Post	
	KWH/Ton	KW/Ton	KWH/Ton	KW/Ton
CAC				
SF - Packaged - Furnace/AC - SEER 15	99.64	0.083	99.64	0.083
SF - Split - Furnace/AC - SEER 15	110.96	0.094	110.96	0.094
SF - Packaged - Furnace/AC - SEER 16	148.81	0.124	148.81	0.124
SF - Split - Furnace/AC - SEER 16	160.93	0.135	160.93	0.135
MH - Split - Furnace/AC - SEER 16a	112.09	0.090	142.71	0.120
SF - Packaged - Furnace/AC - SEER 17	148.81	0.124	190.56	0.157
SF - Split - Furnace/AC - SEER 17	188.72	0.156	188.72	0.156
SF - Split - Furnace/AC - SEER 18	201.45	0.162	201.45	0.162
SF - Split - Furnace/AC - SEER 19	230.41	0.183	230.41	0.183
SF - Split - Furnace/AC - SEER 20	296.59	0.237	296.59	0.237
SF - Split - Furnace/AC - SEER 21b	296.59	0.237	295.49	0.230
SF - Split - Furnace/AC - SEER 22	296.59	0.237	296.76	0.226

Measure	Ex-Ante		Ex-Post	
	KWH/Ton	KW/Ton	KWH/Ton	KW/Ton
SF - Split - Furnace/AC - SEER 23	296.59	0.237	317.80	0.238
SF - Split - Furnace/AC - SEER 25	296.59	0.237	319.31	0.224
SF - Split - Furnace/AC - SEER 26	296.59	0.237	332.61	0.228
ASHP				
SF - Split - ASHP - SEER 15	283.93	0.240	283.93	0.240
MH - Packaged - ASHP - SEER 15	191.86	0.147	191.86	0.147
SF - Packaged - ASHP - SEER 15	299.94	0.256	299.94	0.256
SF - Split - ASHP - SEER 16	382.12	0.275	382.12	0.275
MH - Packaged - ASHP - SEER 16	191.86	0.147	409.16	0.280
MH - Split - ASHP - SEER 16	178.26	0.070	409.25	0.281
SF - Packaged - ASHP - SEER 16	382.51	0.276	382.51	0.276
SF - Split - ASHP - SEER 17	464.24	0.361	464.24	0.361
SF - Split - ASHP - SEER 18	506.73	0.414	506.73	0.414
SF - Packaged - ASHP - SEER 18a	391.53	0.260	729.05	0.500
MH - Split - ASHP - SEER 18	250.95	0.100	540.82	0.422
SF - Split - ASHP - SEER 19	543.93	0.457	543.93	0.457
SF - Split - ASHP - SEER 20	518.05	0.451	518.05	0.451
SF - Split - ASHP - SEER 21	713.64	0.598	713.64	0.598
SF - Split - ASHP - SEER 22	689.96	0.586	689.96	0.586
SF - Split - ASHP - SEER 23	669.16	0.572	669.16	0.572
SF - Split - ASHP - SEER 24	773.20	0.430	798.27	0.648
SF - Split - ASHP - SEER 25	689.80	0.579	689.80	0.579
SF - Split - ASHP - SEER 26	718.53	0.591	718.53	0.591
SF - Split - ASHP - SEER 27	745.13	0.598	745.13	0.598
SF - Split - ASHP - SEER 29	745.13	0.598	792.83	0.598
SF - Split - ASHP - SEER 30	745.13	0.598	814.29	0.591
SF - Split - ASHP - SEER 32a	745.13	0.598	1,441.78	0.562
DFHP				
SF - Split - DFHP - SEER 15	191.86	0.147	191.86	0.147
SF - Split - DFHP - SEER 16	430.90	0.310	430.90	0.310
SF - Packaged - DFHP - SEER 16	269.66	0.195	269.66	0.195
SF - Split - DFHP - SEER 17	465.88	0.363	465.88	0.363
SF - Split - DFHP - SEER 18	399.34	0.337	399.34	0.337
SF - Split - DFHP - SEER 20	844.58	0.681	844.58	0.681

a. New PY10 measure. The Evaluation Team calculated deemed savings as part of the PY10 evaluation for these measures. The TRM Lite will be updated to reflect these additions.

b. TRM Lite values were available, but Implementation Team applied different values.

Ductwork Deemed Savings

Table 87 compares the ex-ante and ex-post deemed savings values for each PY10 ductwork measure. The ex-ante and ex-post deemed values for ductwork measures are identical.

Table 87. Ductwork Ex-Ante and Ex-Post Savings Per-Ton Comparison

Measure	Ex-Ante		Ex-Post	
	KWH/Ton	KW/Ton	KWH/Ton	KW/Ton
Complete duct replacement (HP)	612.00	0.159	612.00	0.159
Complete duct replacement (AC)	342.00	0.159	342.00	0.159
Duct sealing (HP)	362.45	0.103	362.45	0.103
Duct sealing (AC)	221.90	0.103	221.90	0.103
Duct insulation (HP)	249.60	0.056	249.60	0.056
Duct insulation (AC)	120.10	0.056	120.10	0.056

Appendix D. Home Energy Check-up Detailed Methods

Carryover Savings Calculation

The Evaluation Team calculated carryover CFL and LED savings for bulbs placed in storage in PY7, PY8, and PY9 with expected installation in PY10. The Evaluation Team applied assumptions from the 2017 UMP.¹⁶

Carryover Calculation Method for Bulbs Distributed Since PY7

The 2017 UMP's approach cites a 2017 Massachusetts panel study, which found that 24% of the LEDs that went into storage in year one were installed in year two. To estimate the lifetime ISR, the UMP directs evaluators to assume customers continue to install LEDs in storage at a rate of 24% of stored bulbs each year and recommends calculating the percentage of bulbs in storage that are installed each year as follows.

Equation 8. ISR for Bulbs in Storage

$$ISR_{Year\ 1} = ISR_{Surveyed}$$

$$ISR_{Year\ 2} = (100\% - ISR_{Surveyed}) * 24\%$$

$$ISR_{Year\ 3} = ((100\% - (ISR_{Surveyed} + ISR_{Year\ 2})) * 24\%$$

$$ISR_{Year\ 4} = (100\% - (ISR_{Surveyed} + ISR_{Year\ 3})) * 24\%$$

Where:

$ISR_{Surveyed}$	=	ISR from self-reported survey results for the year the measure was distributed (initial program year)
$ISR_{Year\ 2}$	=	Percentage of stored bulbs installed in Year 2 (one year after program participation)
$ISR_{Year\ 3}$	=	Percentage of stored bulbs installed in Year 3 (two years after program participation)
$ISR_{Year\ 4}$	=	Percentage of stored bulbs installed in Year 4 (three years after program participation)

Table 88 below provides the trajectory of in-storage bulb installation for PY10 to PY12, by distribution year.

Table 88. HEC Percentage of Stored Bulbs Installed by Year

Distribution Year	Bulb Type	% Stored Bulbs Installed in PY10	% Stored Bulbs Installed in PY11	% Stored Bulbs Installed in PY12
PY7	CFL	24%	N/A	N/A
PY7	LED	24%	N/A	N/A
PY8	LED	24%	24%	N/A
PY9	LED	24%	24%	24%

¹⁶ Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 6: Residential Lighting Evaluation Protocol. Section 4.10 In-Service Rate. December 2017.

Distribution Year	Bulb Type	% Stored Bulbs Installed in PY10	% Stored Bulbs Installed in PY11	% Stored Bulbs Installed in PY12
PY10	LED	N/A	24%	24%

To calculate carryover CFL and LED savings, the Evaluation Team applied first-year self-reported ISRs and then applied the equations above to estimate the number of in-storage CFLs and LEDs (i.e., from PY7 to PY9) that prior participants installed in PY10. Table 89 summarizes the number of stored CFLs and LEDs prior participants installed in PY10. Ex-post savings includes carryover savings for a total of 261 CFLs and 2,152 LEDs.

Table 89. Quantity of CFLs and LEDs Installed in PY7

Distribution Year	Measure	% Stored Bulbs Installed in PY10	Total Volume in Storage ^a	Volume Installed in PY10
PY7	13 W CFL	24%	1,087	261
PY7	LED ^b	24%	1,013	243
PY8	LED ^b	24%	3,453	829
PY9	LED ^b	24%	4,499	1,080
Total			10,053	2,413

Note: Values rounded for reporting purposes.

^a For PY7, PY8 and PY9, total volume in storage as of PY10

^b Various wattages

Table 90 summarizes the additional carryover gross savings for PY10.

Table 90. HEC Carryover Gross Savings (Savings Added to PY10)

Distribution Year	Measure	Volume Installed in PY10	Ex-Post per-bulb		Total Gross Carryover	
			KWH	KW	KWH	KW
PY7	13 W CFL	261	32.85	0.003	8,571.71	0.783
PY7	LED ^a	243	43.36	0.004	10,541.09	0.972
PY8	LED ^a	829	43.36	0.004	35,937.88	3.315
PY9	LED ^a	1,080	45.13 ^b	0.004 ^b	48,730.71	4.319
Total		2,413	N/A	N/A	103,781.38	9.390

Note: Values rounded for reporting purposes.

^a Various wattages

^b Per-bulb savings reflects a PY9-evaluated assumption that 8% of participants' homes have only incandescent bulbs.

Table 91 summarizes the additional carryover net savings for PY10, applying the same NTGRs from the initial distribution year.

Table 91. HEC Carryover Net Savings (Savings Added to PY10)

Distribution Year	Measure	Total Volume Installed in PY10	Total Gross Carryover		NTGR		Total Net Carryover KWH	
			KWH	KW	KWH	KW	KWH	KW
PY7	13 W CFL	261	8,571.71	0.783	0.79	0.74	6,771.65	0.579
PY7	LED ^a	243	10,541.09	0.972	0.79	0.74	8,327.46	0.720
PY8	LED ^a	829	35,937.88	3.315	0.62	0.62	22,281.48	2.055
PY9	LED ^a	1,080	48,730.71	4.319	0.62	0.62	30,213.04	2.678
Total		2,413	103,781.38	9.390	N/A	N/A	67,593.63	6.032

Note: Values rounded for reporting purposes.

^a Various wattage

Appendix E. Neighborhood Energy Efficiency Program Detailed Methods

Energy Efficiency Kits ISRs

The Evaluation Team fielded a telephone survey of DESC customers who received Energy Efficiency Kits through NEEP in PY10. The team fielded the survey between March 1 and March 15, 2021. The team completed surveys with 105 customers and achieved a response rate of 10.4% (Table 92).

Table 92. Number of Surveys Completed

PY10 Kits Population	Survey Respondents	Response Rate
1,088	105	10.4% ^a

^a. American Association of Public Opinion Research (AAPOR) Response Rate 1.

In the survey, the team asked customers if they recalled receiving the measures, if they had installed them, and if they had removed any of the measures after installation (e.g., if they did not like a measure or it was defective). The team developed ISRs using this data, which reflect the number of measures still installed at the time of the survey. The team calculated the ISRs as follows:

$$\text{In - Service Rate} = \frac{\text{Number of measures verified by survey respondents as still installed}}{\text{Number of measures tracked in the program database as installed}}$$

Table 93 summarizes survey responses and the ISR calculation.

Table 93: NEEP ISRs by Measure

Measure	Total Survey Respondents	Valid Survey Respondents ^a	Measures in Tracking Data (A)	Verified Installed in Survey (B)	Measures Removed (C)	Measures Still Installed (D=B-C)	ISR (D/A)
LEDs	105	100	500	268	14	254	51%
Kitchen faucet aerator	105	105	105	29	4	25	24%

^a. Excludes five respondents who did not recall receiving LEDs.

Appendix F. Multifamily Program Detailed Methods

This appendix provides additional information on the evaluation methods for the Multifamily program. In late 2020, Opinion Dynamics developed deemed energy and demand savings estimates for common area measures offered through the program for planning purposes. The deemed estimates differ from evaluated ex-post savings given ex-post results supplement default assumptions with actual characteristics from project documentation. Below the team presents the algorithms and inputs for estimating energy and demand savings for the Multifamily measures installed in PY10.

Air Source Heat Pumps

Table 94 documents the algorithms and inputs for estimating energy and demand savings from heat pump replacements.

Table 94. Algorithms and Input Assumptions for Heat Pump Replacement

Algorithms			
KWH Savings	= KWH Cooling Savings + KWH Heating Savings		
KWH Cooling Savings	= Btuhcool * (1/SEERbase - 1/SEERee) / 1,000 * FLHcool		
KWH Heating Savings	= Btuhheat * (1/HSPFbase - 1/HSPFee) / 1,000 * FLHheat		
KW Savings	= Btuhcool * (1/EERbase - 1/EERee) / 1,000 * CF		
Parameter	Ex-Ante	Ex-Post	Ex-Post Source/Notes
Cooling Capacity (Btuhcool)	36,000		Use actual capacities from program database and AHRI certificate.
Heating Capacity (Btuhheat)	36,000	34,800	
Baseline Cooling Efficiency (SEERbase)	11.75	14.00	Use actual efficiency from project documentation of existing equipment.
Efficient Cooling Efficiency (SEERee)	16.07	15.75	Use actual efficiency from AHRI certificate.
Baseline Heating Efficiency (HSPFbase)	6.56	8.20	Department of Energy (DOE) Minimum Federal Standard Efficiency for air source heat pumps with 14 SEER.
Efficient Heating Efficiency (HSPFee)	9.01	8.75	Use actual efficiency from AHRI certificate.
Full Load Cooling Hours (FLHcool)	1,431		Developed a ratio comparing cooling degree days (CDDs) for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Multifamily Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Cooling Hours for MF buildings in South Carolina.
Full Load Heating Hours (FLHheat)	620		Developed a ratio comparing heating degree days (HDDs) for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Multifamily Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Heating Hours for MF buildings in South Carolina.
Baseline Cooling Efficiency (EERbase)	10.40	11.76	Calculated by converting SEER to EER. = - 0.02 * SEER2 + 1.12 * SEER
Efficient Cooling Efficiency (EERee)	12.87	13.00	Use actual efficiency from AHRI certificate.
Coincidence Factor (CF)	0.88		IN TRM V2.2. Based on Wisconsin TRM which has a peak period that spans 12 hours like that of DESC (10AM - 10PM).

Duct Sealing

There are two methods used to estimate savings from duct sealing improvements, including:

- Prescriptive – Visual inspection of ducts and the application of the Building Performance Institute’s (BPI) Distribution Efficiency Look-Up Table¹⁷ based on pre- and post- duct conditions; and
- Performance – Relies on actual measured test-in and test-out duct leakage results.

Project documentation provides pre- and post- duct blast test results, therefore ex-post savings rely on the performance approach when estimating savings. However, ex-ante applied deemed savings estimates using the prescriptive method. Table 95 documents the algorithms and inputs for estimating energy and demand savings from duct sealing improvements using the performance approach. Given ex-ante applied a different method, the team is unable to provide a side-by-side variable comparison below.

¹⁷ <http://www.bpi.org/files/pdf/DistributionEfficiencyTable-BlueSheet.pdf>

Table 95. Algorithms and Input Assumptions for Duct Sealing (Performance)

Algorithms		
KWH Savings	= KWH Cooling Savings + KWH Heating Savings	
KWH Cooling Savings	= (((Pre CFM50 - Post CFM50) * 0.64 * (SLF + RLF)) / ((Btuhcool / 12,000) * 400)) * FLHcool * Btuhcool * TRFcool / 1,000 / SEER	
KWH Heating Savings	= (((Pre CFM50 - Post CFM50) * 0.64 * (SLF + RLF)) / ((Btuhheat / 12,000) * 400)) * FLHheat * Btuhheat * TRFheat / 3,412 / COP	
KW Savings	= KWH Cooling Savings / FLHcool * CF	
Parameter	Ex-Post	Source/Notes
Pre CFM50	353	Actual measures test-in and test-out duct leakage results.
Post CFM50	54	
Supply Loss Factor (SLF)	0.50	IL TRM V8.0
Return Loss Factor (RLF)	0.25	
Cooling Capacity (Btuhcool)	36,000	Use actual cooling and heating capacities from project documentation.
Heating Capacity (Btuhheat)	34,800	
Full Load Cooling Hours (FLHcool)	1,431	Developed a ratio comparing CDDs for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Multifamily Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Cooling Hours for MF buildings in South Carolina.
Full Load Heating Hours (FLHheat)	620	Developed a ratio comparing HDDs for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Multifamily Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Heating Hours for MF buildings in South Carolina.
Thermal Regain Factor for Cooling (TRFcool)	1.0	IL TRM V8.0 for ducts located in unconditioned space.
Thermal Regain Factor for Heating (TRFheat)		
Cooling Efficiency (SEER)	14.00	Use actual cooling and heating efficiencies from project documentation.
Heating Efficiency (COP)	2.40	
Coincidence Factor (CF)	0.88	IN TRM V2.2. Based on Wisconsin TRM which has a peak period that spans 12 hours like that of DESC (10AM - 10PM).

Programmable Thermostats

Table 96 documents the algorithms and inputs for estimating energy and demand savings from installing programmable thermostats replacing manually operated thermostats.

Table 96. Algorithms and Input Assumptions for Programmable Thermostats

Algorithms			
KWH Savings	= KWH Cooling Savings + KWH Heating Savings		
KWH Cooling Savings	= (Btuhcool * 1/SEER) / 1,000 * %ElecCool_Savings * FLHcool		
KWH Heating Savings	= (Btuhheat * 1/HSPF) / 1,000 * %ElecHeat_Savings * FLHheat		
KW Savings	= (Btuhcool * 1/EER) / 1,000 * %ElecCool_Savings * CF		
Parameter	Ex-Ante	Ex-Post	Source/Notes
Cooling Capacity (Btuhcool)	36,000	36,000	Use actual capacities from program database and project documentation.
Heating Capacity (Btuhheat)		34,800	
Cooling Efficiency (SEER)	14.00		Use actual cooling and heating efficiencies from project documentation.
Heating Efficiency (HSPF)	8.20		
Cooling Efficiency (EER)	11.76		Calculated by converting SEER to EER. = - 0.02 * SEER ² + 1.12 * SEER
Cooling Savings Factor (%ElecCool_Savings)	2.0%		Mid-Atlantic TRM V9.0. Difference of percent reduction between manual and programmable.
Electric Heating Saving Factor (%ElecHeat_Savings)	2.0%		
Full Load Cooling Hours (FLHcool)	1,431		Developed a ratio comparing CDDs for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Multifamily Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Cooling Hours for MF buildings in South Carolina.
Full Load Heating Hours (FLHheat)	620		Developed a ratio comparing HDDs for South Carolina and Illinois using ASHRAE Fundamentals 2017. Applied this ratio to the Multifamily Full Load Hours from the IL TRM V8.0 to arrive at an adjusted Full Load Heating Hours for MF buildings in South Carolina.
Coincidence Factor (CF)	0.88		IN TRM V2.2. Based on Wisconsin TRM which has a peak period that spans 12 hours like that of DESC (10AM - 10PM).

Lighting

Table 97 documents the algorithms and inputs for estimating energy and demand savings from installing 9.5 W and 14 W LEDs.

Table 97. Algorithms and Input Assumptions for LEDs

Algorithms			
KWH Savings	$= (\text{Baseline Watts} - \text{LED Watts}) / 1,000 * \text{Hours} * \text{WHFe}$		
KW Savings	$= (\text{Baseline Watts} - \text{LED Watts}) / 1,000 * \text{CF} * \text{WHFd}$		
Parameter	Ex-Ante	Ex-Post	Ex-Post Source/Notes
Baseline Watts	43.0 Watts 72.0 Watts		Halogen equivalent for 60W incandescent and 100W incandescent baseline specified in PY10 Multifamily program tracking data.
LED Watts	9.5 Watts 14.0 Watts		Actual installed LED wattage per project documentation.
Hours	4,722		Hours of use for multifamily common area measures per the Texas Technical Reference Manual (TRM) V2.0.
Energy Waste Heat Factor (WHFe)	0.98	1.02	Arkansas TRM V4.0. Applied values that align with actual heating type (heat pump).
Demand Waste Heat Factor (WHFd)	1.20	1.20	
Coincidence Factor (CF)	0.87	0.87	Coincidence factor for multifamily common area measures per the Texas TRM V2.0.

Kitchen Faucet Aerators

Table 98 documents the algorithms and inputs for estimating energy and demand savings from installing kitchen faucet aerators.

Table 98. Algorithms and Input Assumptions for Kitchen Faucet Aerators

Algorithms			
KWH Savings	$= ((\text{Baseline GPM} * \text{Efficient GPM}) / (\text{Baseline GPM})) * \text{Usage} * \text{EPG_elec} * \% \text{Elec WH}$		
KW Savings	$= \text{KWH Savings} / \text{Hours} * \text{CF}$		
Parameter	Ex-Ante	Ex-Post	Source/Notes
Baseline GPM	2.20	2.75	Apartment buildings built in 1986. The Federal standard of 2.2 GPM was not mandated in US until after 1994. Illinois TRM V8.0 defines baseline flow rate for older buildings as 2.75 GPM.
Efficient GPM	1.50	2.00	Actual GPM of installed aerator from project documentation.
Usage (Gallons/Year)	3,650		Varies by space type, occupancy (i.e., average number of occupants daily), and the percentage of hot water from faucets with aerator installed. IL TRM V8.0. Assumed five employees per daily faucet use.
Electric Energy per Gallon (EPG_elec)	0.0595		Calculated using from IL TRM V8.0: $8.33 * 1.0 * (T_{\text{mix}} - T_{\text{inlet}}) / (RE * 3,412)$
Mixed Water Temperature (T_{mix})	93.00 °F		IL TRM V8.0. Cadmus and Opinion Dynamics Showerhead and Faucet Aerator Meter Study Memorandum dated June 2013, directed to Michigan Evaluation Working Group.
Supply Water Temperature (T_{inlet})	69.11 °F		National Renewable Energy Laboratory (NREL) Domestic Hot Water Event Generator calculator for Columbia, SC.
Recovery Efficiency (RE)	0.98		Recovery efficiency for standard electric resistance water heaters (consistent assumption across Illinois TRM, Indiana TRM, Arkansas TRM).
Hours	35.52		Calculated using from IL TRM V8.0: $(\text{Usage} * 0.545) / 56$
Coincidence Factor (CF)	0.0033		Indiana (IN) TRM V2.2 ^f . Based on Wisconsin TRM which has a peak period that spans 12 hours like that of DESC (10AM - 10PM).

Appendix G. EnergyWise for Your Business Detailed Methods

Sample Design

Table 99 provides the sample project stratum for the Prescriptive Lighting samples. The samples for Prescriptive New Construction Lighting, Prescriptive Non-Lighting, and Custom were simple random samples and therefore do not have strata boundaries or any weighting of the sample. All samples were based off the September 2020 closeout file.

Table 99. EWfYB Prescriptive Lighting Sample Stratum and Sampling Parameters

Stratum	Stratum Boundary (KWH)	Population (N) ^a	Sample (n)	Sample Means (KWH)	Stratum Weight	Expansion Weight	Relative Weight
1	1-75,000	290	2	29,617	0.80	145.00	14.50
2	75,001-618,000	80	5	262,355	0.20	16.00	1.60
Certainty	618,001-1,500,000	3	3	1,137,827	N/A	N/A	N/A
Total		373	10				

a. Total number of projects does not match final reported total because sampling occurred on the September 2020 partial dataset.

Realization Rate Summary

Figure 2 and Figure 3 provide a visual comparison between ex-ante and ex-post energy and demand savings across the sampled projects by application type. The line in the graph represents a realization rate of 1.00 (or correlation of 1.00). Generally, the energy savings correlate well between ex-ante and ex-post savings.

Figure 2. EWfYB Ex-Ante vs. Ex-Post – Combined KWH

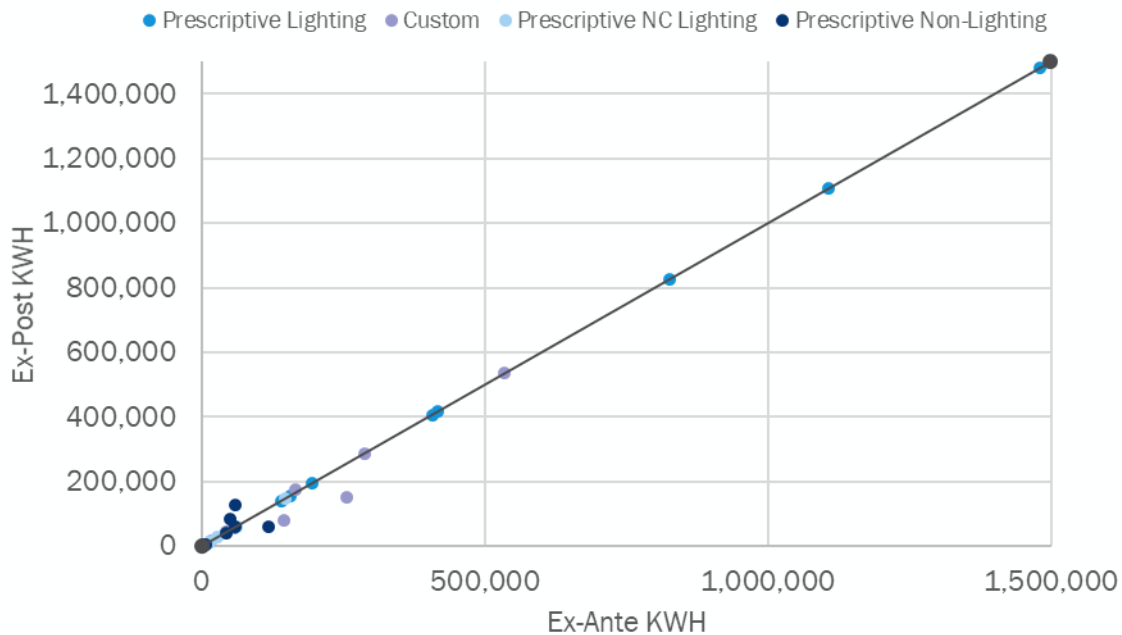
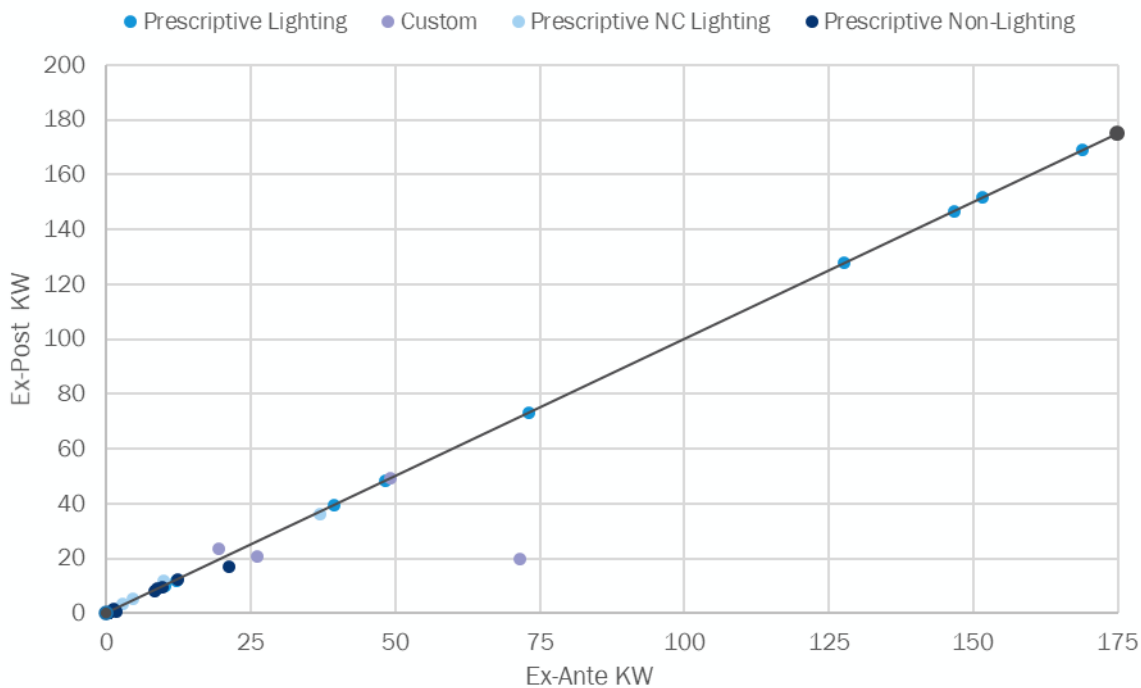


Figure 3. EWfYB Ex-Ante vs. Ex-Post – Combined KW



Desk Review Details by Application Type

Prescriptive and New Construction Lighting

The Evaluation Team performed desk reviews on a sample of 10 out of the 373 Prescriptive Lighting projects and 5 out of the 12 Prescriptive New Construction Lighting projects completed in PY10. For prescriptive lighting projects, the team found ex-ante energy and demand savings calculations to be aligned with the DESC CEAM. Therefore, all ten sample prescriptive lighting projects achieved realization rates of 1.00. For new construction lighting projects, the team found ex-ante energy savings calculations to align with the DESC CEAM; however, demand savings did not, due to the following difference in applied coincidence factors observed in all five sampled projects:

- **Coincidence factors:** Ex-ante calculations applied a generalized coincidence factor for miscellaneous/other building types from the DESC CEAM, 0.747. In instances where a generalized coincidence factor was used, the Evaluation Team adjusted the coincidence factor to align with the building type (e.g., office, warehouse, exterior) based on the CEAM. On average, this adjustment resulted in a 5% increase in energy and demand savings for the five sampled projects.

Table 100 and Table 101 list projects and their individual realization rates in order of largest to smallest ex-post energy savings.

Table 100. EWfYB Prescriptive Lighting Project Realization Rates

Project	Ex-Post KWH	Ex-Post KW	Energy Realization Rate	Demand Realization Rate	Reason for Differences
1	1,479,868	168.91	1.00	1.00	None
2	1,106,889	151.58	1.00	1.00	
3	826,724	146.78	1.00	1.00	
4	415,698	127.72	1.00	1.00	
5	406,099	73.02	1.00	1.00	
6	193,809	48.22	1.00	1.00	
7	156,712	39.46	1.00	1.00	
8	139,458	10.02	1.00	1.00	
9	56,848	12.04	1.00	1.00	
10	2,387	0.92	1.00	1.00	

Table 101. EWfYB Prescriptive New Construction Lighting Project Realization Rates

Project	Ex-Post KWH	Ex-Post KW	Energy Realization Rate	Demand Realization Rate	Reason for Differences
1	147,158	36.14	1.00	0.98	Ex-ante calculations applied a miscellaneous/other building type coincidence factor of 0.747 for all projects. Ex-post uses coincidence factor from the CEAM based on actual building type reported in project documentation.
2	60,615	11.78	1.00	1.20	
3	27,215	5.39	1.00	1.20	
4	13,325	1.81	1.00	1.08	
5	13,150	3.34	1.00	1.20	

Custom Projects

The Evaluation Team performed desk reviews on a sample of 10 out of the 12 Custom projects¹⁸, with the sample consisting of four guestroom HVAC control projects, two chiller replacement projects, one energy management system optimization project, one new construction exterior lighting project, one refrigeration project, and one technical services incentive project. The team employed the following methods to validate ex-ante and develop ex-post savings:

- For the new construction exterior lighting and both chiller replacement projects, where the measures have well-documented savings analysis methods in the CEAM or other technical reference manuals (TRMs), the team leveraged algorithms and assumptions to (1) calculate a comparison savings estimate to ex-ante and (2) adjust the ex-ante analysis where the team identified gaps (e.g., referencing the CEAM for coincidence factors where the ex-ante analysis did not include).
- For the guestroom HVAC control projects, the team reviewed the ex-ante savings analysis and found that its key assumptions did not align with provided project information (e.g., the occupancy factors applied in the ex-ante savings analysis did not match the occupancy characteristics either shown in included energy management system screenshots or reported by the site in responses to our follow-up data request). Therefore, the team developed and applied a deemed savings ex-post analysis method. To develop this ex-post analysis method, the team performed a literature review of TRM-based deemed savings methods, including those from the Illinois, New York, Texas, and Arkansas TRMs.

¹⁸ Upon receipt of the final tracking data, the Evaluation Team opted to sample one additional custom project with 534,600 KWH reported savings (roughly 30% of total ex-ante custom program savings) for review.

From this review, the team determined that the Illinois TRM deemed savings values were based on the most current research of the four. The team then calculated and the ratio of cooling degree days between an Illinois weather city and the project-specific South Carolina weather city to adjust Illinois deemed savings values.

- For the chiller replacement with controls project, the team leveraged a regression model-based consumption analysis to develop ex-post energy savings as the ex-ante analysis used a percent load assumption that the team could not verify based on the included documentation or follow-up data request.
- For two projects involving comprehensive facility upgrades (the energy management system optimization and refrigeration projects), the team relied exclusively on an in-depth review of ex-ante analysis files to validate savings due to limitations of provided data (e.g., no available energy management system data from the site). Therefore, ex-post savings equal ex-ante savings for these two projects.

Table 102 lists projects in order of largest to smallest ex-post energy savings within similar reasons for differences.

Table 102. EWfYB Custom Projects Realization Rates

#	Project Type	Ex-Post KWH	Ex-Post KW	Energy Realization Rate	Demand Realization Rate	Reasons for Differences
1	Guestroom HVAC controls	151,874	0.00	0.59	N/A	Ex-ante and ex-post savings analysis methods differ. The evaluation team developed a DESC-specific deemed savings approach which was then applied to determine ex-post savings.
2	Guestroom HVAC controls	78,774	0.00	0.55	N/A	
3	Guestroom HVAC controls	55,087	0.00	1.01	N/A	
4	Guestroom HVAC controls	45,722	0.00	1.09	N/A	
5	New construction exterior lighting	286,928	20.01	1.00	0.28	Ex-post demand savings include a coincidence factor of 0.28 from the CEAM for exterior lighting.
6	Chiller replacement with controls	176,743	23.50	1.07	1.21	Ex-post energy savings determined through a regression model-based consumption analysis; ex-post demand savings used algorithms and assumptions from the CEAM.
7	Chiller replacement	42,721	20.80	1.00	0.80	Ex-post demand savings include a coincidence factor of 0.80 from the CEAM for chillers.
8	Energy management system optimization	534,600	49.20	1.00	1.00	None
9	Refrigeration	16,414	0.46	1.00	1.00	
10	Technical services incentive	0.00	0.00	N/A	N/A	

Note: The Evaluation Team cannot calculate realization rates when the ex-ante or ex-post savings are 0, and therefore denote these projects with 'N/A.'

Prescriptive Non-Lighting Projects

The Evaluation Team performed desk reviews on a simple random sample of 12 out of 31 Prescriptive Non-Lighting projects. For Unitary HVAC and HVAC Chiller measure types in the project sample, the team found a discrepancy between the ex-ante baseline efficiency values and those specified in the CEAM. For HVAC Variable Frequency Drive measures, the team found a rounding difference in the KW calculations. Ex-ante calculations for glass door reach-in refrigerator and convection ovens were found to be in alignment with the CEAM and therefore achieved realization rates of 1.00 for energy and demand savings. Table 103 details realization rates and differences between ex-ante and ex-post savings for the 12 sampled projects by specific measure type.

Table 103. EWYB Prescriptive Non-Lighting Realization Rates

Project	Measure Type	Ex-Post KWH	Ex-Post KW	Energy Realization Rate	Demand Realization Rate	Reasons for Differences
1	Unitary HVAC	127,322	9.77	2.15	1.01	Ex-ante uses different baseline efficiency values. Ex-post uses values aligning with the 2019 CEAM.
2	Unitary HVAC	84,744	8.37	1.69	1.01	
3	Unitary HVAC	59,104	16.82	0.51	0.80	
4	Unitary HVAC	3,886	1.46	1.43	1.19	
5	HVAC variable frequency drives	58,679	12.54	1.00	1.01	Rounding difference for KW.
6	HVAC variable frequency drives	41,876	8.95	1.00	1.01	
7	Glass door reach-in refrigerator	3,708	0.42	1.00	1.00	None
8	Glass door reach-in refrigerator	2,978	0.34	1.00	1.00	
9	Convection ovens	1,937	0.44	1.00	1.00	
10	Convection ovens	1,937	0.44	1.00	1.00	
11	HVAC chiller	4,594	0.54	0.63	0.32	Ex-post calculations use CEAM-specified minimum baseline efficiencies; ex-post calculations applied a CEAM-specified cooling effective full-load hour value (EFLHc) for the nearest weather city to project-site whereas ex-ante applies the average EFLHc value from the CEAM.
12	HVAC chiller	2,241	-0.82	1.00	-2.36	

Appendix H. Small Business Energy Solutions Detailed Methods

Desk Review Sample Design

Table 104 and Table 105 below provide the sample project stratum for the lighting and refrigeration stratified random samples. All samples were based off the partial dataset file used for sampling purposes.

Table 104. SBES Lighting Sample Stratum and Sampling Parameters

Stratum	Strata Boundary (KWH)	Population (N) ^a	Sample (n)	Sample Means (KWH)	Stratum Weight	Expansion Weight	Relative Weight
1	1–5,000	179	5	3,120	0.397	35.68	1.43
2	5,001–10,000	126	4	7,840	0.279	31.63	1.27
3	10,001–36,000	146	16	17,576	0.324	9.13	0.37
Total		451	25				

a. Total number of projects does not match final reported total because sampling occurred on the September partial dataset.

Table 105. SBES Refrigeration Project Sample Stratum and Sampling Parameters

Stratum	Strata Boundary (KWH)	Population (N) ^a	Sample (n)	Sample Means (KWH)	Stratum Weight	Expansion Weight	Relative Weight
1	1–5,000	5	2	3,120	0.235	2.99	0.30
2	5,001–10,000	5	2	7,840	0.294	2.15	0.21
3	10,001–17,500	8	6	17,576	0.471	1.33	0.13
Total		18	10				

a. Total number of projects does not match final reported total because sampling occurred on the September partial dataset.

Desk Review Detailed Findings

Lighting Projects

The lighting desk review sample included 25 projects consisting of interior, exterior, and refrigerated case LED measures. For each project, the Evaluation Team requested all applicable project documents such as project proposals, invoices, specification sheets, and other calculation files, as necessary. Documentation for the projects included a project proposal that included the energy savings values, but not demand savings values, even though the program-tracking database includes demand savings for many of the sampled projects. For ex-post savings, the Evaluation Team applied algorithms and assumptions from the 2019 DESC CEAM, substituting actual lighting measure information from project documents, where available. To determine ex-post gross savings, several parameters within the lighting calculations were adjusted, including:

- **Building Type:** Discrepancies between ex-ante and ex-post building types were observed in 83% of desk-reviewed lighting measures. Ex-ante building types were assigned at the project level and distributed throughout the individual measures within that project. To calculate ex-post savings, the Evaluation Team reviewed the ex-ante building type classification and adjusted at the measure level as appropriate. For example, some exterior lighting measures were improperly specified as interior lighting measures using project-level information, resulting in the application of incorrect waste heat factors and/or coincidence factors for exterior lighting. The Evaluation Team adjusted building types on a measure-by-measure basis.

- **Coincidence Factors and Waste Heat Factors:** The Evaluation Team applied CEAM-specified coincidence factors and waste heat factors corresponding to the adjusted building type (e.g., office, warehouse, exterior). Since there are no ex-ante demand calculation methods available for review, it is unclear what coincidence factors or demand waste heat factors were used to estimate ex-ante savings. The Evaluation Team, therefore, cannot pinpoint specific differences between ex-ante and ex-post demand savings.
- **Exterior Lighting Demand Savings:** The program tracking database did not include ex-ante demand savings for most exterior lighting measures. The Evaluation Team calculated demand savings using project-specific demand reductions and the CEAM-specified coincidence factor for exterior lighting. Demand savings from the sampled exterior lighting measures account for 2% of the sampled lighting project ex-post savings total.

Table 106 details the 25 sampled projects and their individual realization rates, along with a short description of what caused the differences in ex-post and ex-ante savings. Table 106 lists projects in order of largest to smallest verified energy savings, grouped by causes of differences.

Table 106. SBES Lighting Project Realization Rates

Project	Ex-Post KWH	Ex-Post KW	KWH Realization Rate	KW Realization Rate	Reasons for Differences
1	34,499	13.78	1.05	1.20	Ex-post savings applied coincidence and/or waste heat factors from the CEAM for the appropriate building type.
2	22,016	6.28	1.05	1.03	
3	20,728	6.35	1.00	1.25	
4	19,249	6.76	1.00	1.21	
5	18,632	3.92	1.00	1.38	
6	13,636	6.62	1.00	1.25	
7	12,841	7.67	1.00	0.86	
8	12,629	6.64	1.00	1.20	
9	12,555	5.37	1.04	1.20	
10	11,513	11.70	1.00	1.25	
11	10,179	5.65	1.00	1.75	
12	8,990	3.04	1.05	1.41	
13	7,366	2.18	1.05	1.25	
14	7,188	1.98	1.05	1.25	
15	4,370	2.27	1.05	1.46	
16	4,165	3.34	0.97	1.28	
17	2,307	1.72	1.00	1.25	
18	210	0.18	0.95	1.18	
19	27,277	5.53	1.01	1.37	Ex-post savings applied coincidence and/or waste heat factors from the CEAM for the appropriate building type. The program-tracking database did not include ex-ante demand savings for exterior lighting measures.
20	24,279	3.42	1.00	1.95	
21	18,476	5.93	1.05	1.36	
22	16,083	5.16	1.01	1.03	
23	11,457	4.25	1.04	1.19	
24	8,909	9.47	1.00	1.23	The program-tracking database did not include ex-ante demand savings for exterior lighting measures.
25	4,630	0.36	1.00	N/A	

Refrigeration Projects

The 10 projects selected for the refrigeration sample consist of four separate refrigeration measures: evaporative/compressor controls, electronic commutated motor (ECM) retrofits for walk-in coolers/freezers, cooler/freezer door heater controls, and novelty cooler shutoff controls. The Evaluation Team verified that ex-ante calculations use CEAM-aligned methods and leverage actual measure information, where applicable. The Evaluation Team reviewed ex-ante methods for any apparent errors or inconsistencies and made the following adjustments when developing ex-post savings:

- **Novelty Cooler Shutoff Demand Savings:** The Evaluation Team calculated ex-post demand savings in accordance with the CEAM, whereas the program-tracking database did not report ex-ante demand savings. Demand savings from the sampled novelty cooler shutoff measures account for 70% of the sampled refrigeration project ex-post demand savings total.

- **ECM Retrofits for Walk-in Coolers/Freezers:** Ex-ante calculations did not apply a coincidence factor to demand savings. Ex-post demand estimates therefore applied the CEAM-specified coincidence factor of 0.75.

Table 107 details the 10 sampled projects and their individual realization rates, along with the source of differences in ex-post and ex-ante savings. Table 107 lists projects in order of largest to smallest verified energy savings, grouped by similar reasons for differences.

Table 107. SBES Refrigeration Project Realization Rates

Project	Ex-Post KWH	Ex-Post KW	KWH Realization Rate	KW Realization Rate	Reasons for Differences
1	13,389	0.81	1.00	0.81	Ex-post calculations applied the CEAM-specified coincidence factor of 0.75 to demand savings for walk-in cooler/freezer ECM retrofit measures. Rounding discrepancies in ex-ante calculations.
2	12,238	0.73	1.00	0.81	
3	7,845	0.49	1.00	0.81	
4	4,777	0.27	1.00	0.81	
5	3,243	0.16	1.00	0.81	
6	11,338	2.80	1.00	6.98	The program-tracking database did not include ex-ante demand savings for novelty cooler shutoff measures. Ex-post applied the CEAM-specified coincidence factor of 0.75 to demand savings for walk-in cooler/freezer ECM retrofit measures. Rounding discrepancies in ex-ante calculations.
7	11,226	2.60	1.00	4.33	
8	10,546	2.39	1.00	3.98	
9	8,415	1.23	1.00	3.53	
10	10,152	3.53	1.00	8.37	The program-tracking database did not include ex-ante demand savings for novelty cooler shutoff measures.

For more information, please contact:

Megan Campbell
Senior Vice President

858-270-5010 tel
mcampbell@opiniondynamics.com

1000 Winter Street
Waltham, MA 02451



Boston Headquarters	San Francisco Bay	San Diego	Portland
617 492 1400 tel 617 492 7944 fax 800 966 1254 toll free	510 444 5050 tel 510 444 5222 fax	858 270 5010 tel 858 270 5211 fax	503 287 9136 tel 503-281-7375 fax
1000 Winter Street Waltham, MA 02451	1 Kaiser Plaza Suite 445 Oakland, CA 94612	7590 Fay Avenue Suite 406 La Jolla, CA 92037	3934 NE MLK Jr. Blvd. Suite 300 Portland, OR 97212